SMALL RUMINANT PRODUCTION SYSTEMS NETWORK FOR ASIA

PROCEEDINGS OF THE INAUGURAL MEETING AND LAUNCHING OF THE ASIAN SMALL RUMINANT INFORMATION CENTRE, KUALA LUMPUR, MALAYSIA, 21-23 AUGUST 1989

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SMALL RUMINANT PRODUCTION SYSTEMS NETWORK FOR ASIA

Proceedings of the inaugural meeting and launching of
the Asian Small Ruminant Information Centre,
Kuala Lumpur, Malaysia, 21-23 August 1989

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ABSTRACT

This publication presents the results of a meeting held in Kuala Lumpur, Malaysia, 21-23 August 1989, whose primary objective was to examine the formation of a network to support research and development activities for small ruminants in national agricultural systems and collaborative research programmes in Asia. There was consensus that a single network should be established for small ruminants in Asia whose name should be Small Ruminant Production Systems Network for Asia (SRUPNA). It was also agreed to establish a centralised information facility called Asian Small Ruminant Information Centre (ASRIC) to be based in the Central Sheep and Wool Research Institute (CSWRI) in Avikanagar, India. A three man Steering Committee was appointed to determine the location of the coordination unit to pursue the objectives, as well as future activities of SRUPNA and ASRIC.

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FOREWORD

Small ruminants, goats and sheep represent important resources in Asia, where they account for about 51 and 21% respectively, of the total world population of these species. The extent of their importance is reflected in a large number of breeds distributed across various agro-ecological regions, producing meat, milk and fibre of considerable socio-economic importance to the rural poor.

The fact remains however, that despite their apparent value and advantages, these small ruminants are largely neglected in research and development. Potential possibilities of extending the contribution are enormous and which is good justification for focusing on the avenues for increasing productivity from these species.

The Animal Production Systems (APS) program within the Agriculture, Food and Nutrition Sciences Division gives high priority to support research and development of small ruminants, and in line within this, was pleased to be able to convene this important meeting.

The creation of the Small Ruminant Production Systems Network for Asia (SRUPNA) and the Asian Small Ruminant Information Centre (ASRIC) reported in this publication represents another important step in the support for promoting the development of small ruminants. It is hoped that the initiative to create both of these can collectively, through the participation of national agricultural research systems as well as other international agencies, sustain the long term objectives and benefits of both centres.

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SESSION I

COUNTRY STATEMENTS

NETWORKS AND NETWORKING

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ABSTRACT

The paper provides a comprehensive background on networks and discusses their operation with reference to characteristics, principles of networking, coordination, funding and problems. Special mention is made about the advances that have been made in the Asian Rice Farming Systems Network (ARFSN).

INTRODUCTION

Agricultural research in most developing countries has limited manpower and financial support, although agriculture has the highest contribution in their GNP. In order to accelerate the increase in production of major food commodities in developing countries, national programs have established nationally or regionally coordinated research programs and international research centres were established to help national programs. Institutions were established to coordinate research in Philippines (PCARRD), Indonesia (AARD), India (ICAR), Malaysia (MARDI), Pakistan (PARC), China (CAAS) and others. In other countries the agriculture department or agency coordinates and implements research. With the establishment of international research centres, agricultural research became the most multinational of all scientific endeavors. Countries are depending more and more on each other and the international research centres, especially for new improved germplasm, research methodologies, improved technologies and research information. The network schemes become the linkage for collaborative research, not only at the international level but also at the national level.

There are many networks in different parts of the world. Over one hundred international agricultural networks are operational and it is further increasing. Some networks have combined their efforts under another network umbrella to further coordinate their activities in developing countries.

National programs have their own national networks of different kinds. Today we will discuss the formation of another network. This paper will present some of the networks, with detailed discussion of two networks I am familiar with.

Hopefully, this presentation can help the group in establishing the Small Ruminant Network.

NETWORKS

There are many operational networks throughout the world dealing with agricultural research and development. Networks can be national,

regional and international in scope. Most national programs have their own networks to bring scientists to work together and develop technologies to increase production of important food commodities. Network schemes are popularised by international research centres to bring together scientists from different countries and disciplines to work together and sharply focus technology development for different environments. These networks can be grouped into 3 kinds: international nurseries, factor-related collaborative research, and information exchange. Almost all international research centres have international nurseries. The nurseries typically screen for high yield and wide adaptability and more specific nurseries measure resistance to pests and environmental stress. Other organisations also sponsor networks on varietal evaluation such as FAO, ACIAR, ASEAN, etc. The nurseries distributed by international research centres are corn (CIMMYT and IITA), wheat (CIMMYT and ICARDA), sweet potato (AVRDC and IITA); millet (ICRISAT), fababean (ICARDA), mungbean (AVRDC), forage crops (ACIAR, CIAT and ILCA), cassava (CIAT and IITA), white potato (CIP), sorghum (ICRISAT and CIMMYT), peanut (ICRISAT), soybean (IITA and AVRDC), pigeonpea (ACIAR and ICRISAT), bean (CIAT), and others. FAO also provides funds and coordinates regional nurseries on legumes, sesame and others.

Several networks are organised to deal with problems related to factors of production. Some of the networks are the Asian Rice Farming Systems Network (IRRI), West African Farming Systems Network (IITA), International Network for Sustainable Rice Farming (IRRI), Southeast Asian Program for Potato Research and Development (CIP), Alley Farming Network for Tropical Africa (IITA), Africa Research Network for Agricultural By-Products (ILCA), Cattle Research Network (ILCA), Asian Grain Legume Program (ICRISAT) and Africa Trypanotolerant Livestock Research (ILCA) and others. Some combined international nurseries and factor-related activities such as the Asian Rice Farming Systems Network, Asian Grain Legume Program, Pasture Network for Eastern and Southern Africa, and others. Many international centres have information exchange networks.

It is very difficult to cover the activities of all the networks. I will discuss in detail two examples: one representing international nurseries (International Rice Testing Program) and the other factor related (Asian Rice Farming Systems Network).

International Rice Testing Program (IRTP)

IRTP is coordinated by IRRI and a very important component of the Genetic Evaluation and Utilisation program. It was established in 1975 to provide a mechanism for exchange of elite rices among rice scientists in different countries for their evaluation and utilisation in their respective environments. The main objectives are:

a) To make the world's elite germplasm available to rice scientists around the world for direct use or for use in their breeding programs.

b) To provide rice scientists with an opportunity to evaluate their own advanced breeding lines over a wide range of climate, cultural, soil, diseases and insect conditions.

c) To identify varieties with broad spectrum of resistance to

insects, diseases, problem soils and other stresses.

d) To serve as a centre for information on interaction of varietal characteristics with diverse wide growing environment in the world.

e) To promote interactions among rice scientists in the world.

There are more than 800 scientists involved from different countries in Asia, Africa, Latin America, North America, Europe and Oceania. More than 29 different types of nurseries are distributed each year to different countries.

One type of nurseries is for evaluation of superior varieties for different rice cultural types. The other types are for identifying donors for biological, physical, and chemical stresses. In 1987, there were 29 different nurseries: 7 are for evaluation of superior varieties in irrigated, rainfed lowland and upland rice ecologies; 10 are for observational nurseries in irrigated, rainfed lowland, upland, deep water and tidal prone rice; 3 for disease screening; 3 for insect screening; 1 for nematode screening, 3 for problem soils, 1 for temperature tolerance, and 1 for grain quality (Table 1). The number of nurseries and number of entries change. Some are dropped and some are added. Entries are decided not by IRRI but an advisory committee composed of national rice coordinators/program leaders. The committee meets every year during the international rice conference or workshops. It decides on the data to be collected and the kind of nurseries and entries to be included.

At the beginning, the majority of the entries came from IRRI. Now about 70% of the entries are coming from national programs and the rest from the IRRI, Genetic Evaluation and Utilisation Program. In other international centres the entries come mostly from their own breeding programs. Their contributions are sent to IRRI for multiplication (if seeds are not enough) and trials are sent by IRRI, complete with instructions and data format to interested scientists.

Each collaborator is encouraged to collect the data using the agreed upon format, and a copy is sent to the IRRI coordinator for analysis and to summarise the performance across different countries. Data is published annually and distributed to all collaborators. Collaborators are encouraged to publish the results of the trial in their own country. National programs are free to use the promising varieties for use in their own breeding program and for national distribution using their own nomenclature for naming the varieties.

Each nursery has a fixed number of entries decided by the advisory committee and the number of entries received by the IRRI coordinator. Local checks are included by collaborators (1-2 checks). A nursery is evaluated in different environments. For example, International Rice Yield Nursery - Very Early (irrigated) have 24 entries and 90 sets were distributed in 1987 to 14 countries in Asia, 8 countries in Africa, and 5 countries in Latin America.

The coordinator and advisory committee do not assign the trials. Each country requests the kinds of trial they need. Usually requests are made during meetings, monitoring tours, conferences and workshops. Most of the trials are requested by the national rice coordinators.

TABLE 1. IRTP NURSERIES DISPATCHED FROM IRRI IN 1987

Nursery Yield	No. of entries	Sets dispatch (no.)	No. of countries
International Rice Yield Nursery-Very Early	24	90	29
International Rice Yield Nursery-Early	24	85	26
International Rice Yield Nursery-Medium	24	66	21
International Upland Rice Yield Nursery-Early	19	64	20
International Upland Rice Yield Nursery-Medium	20	43	18
International Rainfed Rice Shallow Water Yield Nursery-Early	19	31	11
International Rainfed Rice Shallow Water Yield Nursery-Medium	18	47	15
Observational			
International Rice Observation Nursery-Very Early	26	87	31
International Rice Observation Nursery-Early	61	82	29
International Rice Observation Nursery-Medium	90	69	29
International Upland Rice Observation Nursery-Early	31	70	21
International Upland Rice Observation Nursery-Medium	46	54	19
International Rainfed Rice Shallow Water Observation Nursery-Early	14	47	16
International Rainfed Rice Shallow Water Observation Nursery-Medium	75	51	18
International Rice Deep water Observation Nursery	73	47	17
International Floating Rice Observation Nursery	14	29	12
International Tide-Prone Rice Observation Nursery	29	18	9
Stress Screening Diseases			
International Rice Blast Nursery	109	118	37
International Rice Bacterial Blight Nursery	47	57	16
International Rice Tungro Nursery	62	24	7
Insects			
International Rice Brown Plant Hopper Nursery	67	45	13
International Rice Whitebacked Plant Hopper Nursery	29	34	11
International Rice Stem Borer Nursery	35	52	14
Nematode			
International Rice Ufra Screening Set	43	16	7
Problem Soils			
International Rice and Alkalinity Tolerance Observation Nursery	81	85	25
Acid Lowland Soil Screening Set	78	31	12
Acid Upland Soil Screening Set	52	25	13
Temperature			
International Rice Cold Tolerance Nursery	63	79	29
Grain Quality			
International Rice Grain Quality Screening Set	18	4	4
Total	1291	1550	

IRTP organises monitoring tours annually (2-3 times) for scientists in different national programs to visit the different testing sites and jointly reviews the performance of the entries in the IRTP nurseries and national breeding trials. Subject matter workshops are also organised to exchange ideas and develop strategies for rice varietal improvement for different environments. IRTP activities are always discussed during the annual international rice conference, which is now organised once every 2 years. The advisory committee meets every year usually after the rice conference or subject matter workshops.

IRRI does not provide funds for the trial. All are funded by their own national breeding program. IRRI sometimes provides funds for training of scientists and participation in monitoring tours, workshops and meetings. The travel of advisory committee members to attend meetings is usually funded by IRRI.

ITRP has a coordinating unit and an advisory committee. The members of the advisory committee are the coordinators/leaders of rice research in major rice producing countries. The coordinating unit of IRTP is located in IRRI, and it is one of the global service departments with 2 senior staff. Three senior staff are assigned outside IRRI: one in Haiti to cover Latin America and the Caribbean in collaboration with CIAT, another in IITA for West Africa in collaboration with IITA, and another in Tanzania for East Africa. The advisory committee is regionalised: there is one in Asia, where 90% of the rice is produced; another in Latin America including the Caribbean; and another in Africa. The overall coordinator attends most of the regional committee meetings. Some committee members attend meetings in other regions.

Training is also one important component of the network. IRRI trains rice scientists around the world in genetic evaluation and utilisation which is one of the major components of IRTP. A 4-month course is offered 1-2 times a year with focus on varietal improvement by rice ecology (irrigated, rainfed lowland, deep water, and upland rice).

Asian Rice Farming Systems Network (ARFSN)

The network started in 1975 as a cropping systems network in collaboration with national programs and other research organisations. With the expansion of the activities to animal, aquaculture, and agro-forestry, the network became a farming systems research network in 1983. It is a component of the IRRI Cropping/Farming Systems Program. It is a scheme for IRRI and national programs to work together to increase food production in Asia by identifying more productive rice-based farming systems which are acceptable to small scale farmers. The specific objectives are:

a) To develop and coordinate collaborative research in farming systems with major emphasis on problems common in Asia.

b) To provide a mechanism for sharing information, technology and methodology generated by IRRI, national programs and other international programs.

c) To conduct collaborative research on major production systems in

key sites and component research in selected key sites and research stations.

d) To provide a feedback mechanism to call the attention of IRRI and national research systems to field identified programs.

IRRI provides the coordination and a working group is created to provide guidance and direction to its collaborative research activities. The group is composed of national cropping/farming systems program leaders/coordinators, and the IRRI network coordinator and an economist. Each country is represented by one scientist in the working group, except China with two. The working group decides any collaborative research to be undertaken. The general procedure is to discuss during the working group meetings the proposed area of collaboration, the data format and methodologies to use, then identify the sites or countries that will conduct the experiments. Each country is expected to provide manpower and funds for the collaborative research. However, the network helps in getting funds from donor agencies. IRRI has funds only for meetings and limited funds for training. The working group met twice a year in the early years of the network, and in the last 8 years it has been meeting annually. The 20th meeting is scheduled in Indonesia on October 2-7, 1989. At every meeting, collaborative research activities are reviewed, methodologies on production systems are updated, and problems and research issues are identified.

Since IRRI's expertise is only on rice, the network collaborates with selected national research institutions to conduct component research on major problems and provide technical backstopping to the scientists involved in the network.

Examples are animal research with the Philippine Institute of Animal Sciences; aquaculture with the Philippine Freshwater Aquaculture Research Centre and Indonesian Freshwater Aquaculture Research Institute; and varietal improvement of upland crops with the Philippine Institute of Plant Breeding, Thailand Field Crops Research Institute and Indonesian Central Research Institute for Food Crops.

There are two kinds of collaborative research: component technology and production systems which are priority problems in the region. Experimental designs vary from country to country, although there is uniformity in data collection for each collaborative research. The main objectives of the collaboration are to generate technology for the target key sites and develop methodologies that can be used by scientists in Asia and other countries. The production systems collaboration are on cropping pattern testing in six countries, women in rice farming in six countries, crop-animal systems research in five countries, prosperity through rice in four countries, rice-fish farming in six countries, impact of cropping systems research in five countries, rice-wheat cropping systems in six countries, and data management of on-farm trials in three countries. Collaboration on component research which are conducted in either experiment stations or farmers' field are on varietal improvement and testing of upland crops in 13 countries, long-term cropping pattern trials in five countries and farm implement for intensive cropping in five countries. There are 17 countries involved in the network.

Note that collaborative research involves only few countries. The

research output is disseminated to other members through exchange of publications, workshops, monitoring tours, working group meetings and scientist visits. The output is also disseminated within each country since the working group members are the program leaders.

Let me discuss in detail one collaborative research in ARFSN which is related to the proposed Small Ruminant Network. Some of the national scientists involved are probably the same. The crop-animal farming systems research started in 1984 with IDRC funding. A workshop was held in 1983 to review the state-of-the-art, discuss research methodologies, identify the research agenda and set the objective of the collaboration. Participants came from six selected countries, although there were 14 countries involved in the network.

There were more than 100 cropping systems research sites in 14 countries in 1983. The project identified only seven cropping system sites and expanded the activities to include the animal component as the key farming system site for the network (Table 2).

The activities of the crop-animal project consist of on-station research in the Philippines Institute of Animal Science (IAS), Farming Systems and Soils Resources Research Institute (FSSRRI) and IRRI; and on-farm research in key farming sites. The work in IAS is concentrated on determining nutrition values of local fodder, dual-purpose crops (such as pigeonpea, cowpea, mungbean, maize and sorghum), and other promising forage crops in food-forage crop production systems. IRRI is studying forage crops and intercropping of food-forage crops such as mungbean, cowpea and pigeonpea intercrop with forage legumes (siratro, clitoria, lablab bean, desmanthus, etc.). IRRI is collaborating with CIAT and ACIAR for some promising varieties of forage crops.

Activities in the key sites are implemented by national programs with support from IDRC (China, Philippines, Indonesia and Thailand) and USAID (Nepal). The on-experiment station researches using the IRRI and IAS model and on-farm researches are promoted in national programs not only in countries involved in the collaboration but in all the 17 countries involved in the network. For example, in the Philippines there are two key farming system sites involved in the network which is part of the national research. In 1989, more than 30 sites are conducting crop-animal research which were formerly cropping systems sites.

The same is true with other national programs. Most of their cropping system sites incorporated the animal component in their research. On-station research is also being reoriented to develop component technology for crops and animal that will increase the production of crop-animal farming systems practices by small scale farmers.

Scientists involved in the collaboration meet annually. The network organised crop-animal monitoring tours in 1984 (Philippines and Thailand), 1985 (Indonesia and Thailand), and 1987 (China and Philippines). Crop-animal farming workshops were held in 1983 (IRRI, Philippines), 1986 (Khon Kaen, Thailand) and 1988 (Serdang, Malaysia). In addition to the collaborators, other animal, social and crop scientists involved in the network participated.

TABLE 2. CROP-ANIMAL FARMING SYSTEMS KEY SITES IN DIFFERENT COUNTRIES (1988)

Site	Rice Land	Crop	Animal
Sta. Barbara, Pangasinan, Philippines	Irrigated and rainfed lowland	Rice, mungbean, bean, cowpea, forage crops	Cattle, swine
Trece Martirez Cavite, Philippines	Upland rice	Rice, corn, cassava, forage crops	Cattle, swine
Batumarta, South Sumatra, Indonesia	Upland rice (acid soil)	Rice, corn, peanut, forage crops, soybean	Goat, cattle, chicken
Ban Phai, Khon Kaen, Thailand	Rainfed lowland	Rice, green corn, cowpea, forage crops	Beef cattle
Naldung, Nagarkot, Nepal	Rainfed lowland (hills)	Rice, wheat, corn, finger millet, forage oat, forage crops	Dairy buffaloes
Chang Ping, Beijing, China	Irrigated lowland	Rice, wheat, triticale, corn, soybean, vegetables, forage crops	Dairy cattle
Fumashuang, Jiangsu, China	Irrigated lowland	Rice, wheat, soybean, rapeseed	Swine

The objectives are:

1) To establish collaborative research on crop-animal production systems between IRRI and national programs in Asia.

2) To develop and refine crop-animal research methodologies to be used in the Asian Farming Systems Network.

3) To further develop relevant component technologies for both crops and animal systems.

4) To facilitate exchange of research information and ideas among scientists in Asia on crops and animal production systems.

5) To promote collaborative research between crops and animals scientists.

The ARFSN organises workshops, working group meetings, and monitoring tours to review progress of collaboration, identify problems, exchange information and plan collaborative research. In 1989, the network organised the following meetings:

1) Varietal Improvement of Upland Crops for Rice Farming, March 20-25 in Nepal.

2) 20th Meeting of the Asian Rice Farming Systems Working Group, October 2-7 in Indonesia.

3) Rice-Fish Farming Systems Workshop, October 23-28 in the Philippines.

There are several training programs in IRRI to support the activities on farming systems research and development. These are 4-month Farming Systems, 4-month Varietal Improvement of Upland Crops, 1-month Varietal Testing of Upland Crops, and other unscheduled on-the-job training such as 1-month Cropping Systems Entomology, 2-month Upland Crops Establishment and 2-month Cropping Systems Weed Management.

IRRI provides the coordination of the network. The coordinating unit consists of a coordinator, who is the head of the Rice Farming Systems Program (a global service department), a statistician for the data management, an economist for the Women in Rice-Farming, another economist for Impact of Farming Systems Research, and an agronomist for the Prosperity with Rice. Other members of the coordinating unit who are not from IRRI are an aquaculture scientists from ICLARM on rice-fish farming, a legume breeder from Philippine Institute of Plant Breeding on varietal improvement of upland crops for rice farming, forage crop scientists from Thailand Khon Khan University, and an animal scientist from the Philippine Institute of Animal Sciences for crop-animal farming systems.

Common Characteristics of Networks

The most common characteristics of all existing international networks are the following:

a) Each has well defined objectives.

b) Participants are consulted on all the activities from planning to implementation.

c) There is a steering/executive/advisory committee or working group that provides guidance and direction to its collaborative research activities.

Members are national program leaders or well known senior scientists from participating countries. Most participating countries are represented.

d) There is a coordinating unit with a coordinator assigned with one of the collaborating institutions. In some cases, chairman of the committee functions as coordinator. In most cases, there is a chairman of the committee and a coordinator.

e) Participants shoulder the cost of the research and provide technical manpower and facilities. In several cases, additional funds are provided to carry out the collaborative research.

f) There is regular exchange of information through any or combination of the following: meetings, workshops, monitoring tours, scientist visits and exchange of publications.

g) Training is provided to scientists either at the graduate level or non-degree. Some are on-the-job training.

h) Existing manpower is used, although in some cases additional manpower is provided through a project.

PRINCIPLES OF NETWORKING

The area of collaboration must be a problem in a wider scale so that each participant will benefit in the solution of the problem. Realistic research agenda should be developed by the participating scientists and not by the coordinator or leader. It should not be designed as a fixed experiment across different countries but flexible enough to adjust depending on capabilities of the participating scientists, the environment and problems of participating country. The participants should be able to contribute in the design and identification of treatments. Common data can be gathered but it should be flexible to include other information needed by participating scientists.

Each researcher should analyse their own data and write up the results as their own publication. Since the problems have regional implications, individual and cross-country analysis can be done to explain regional implications. The analysis can be done by the coordinating unit or by any of the participating scientists.

Research problem must be widely shared. Participants will be motivated to collaborate only if they feel there is something to gain from the collaborative research efforts. The collaborative research must be part of their regular research agenda and not a special research project for the network, especially if funds are provided.

Collaborators must commit some of their own resources, not only manpower and facilities but also operational costs. The collaborative efforts must be part of the research program of the institution to solve local problems. It should have the approval of the administration of the collaborating institutions. All contributions of the collaborating institutions and the network should be clearly spelled out and that everybody understands their role in the collaboration.

Although financial, manpower and facilities are expected, it is desirable in most cases to provide additional funding to carry out the collaborative research efforts, especially for specialised equipment, training of participating scientists, participation in meetings, conferences, workshops and, to some extent, operational cost. Funding is important, especially at the beginning to start and hopefully later

funds can be gradually incorporated in their own program. Since most national programs have restrictions on international travel, outside funding is always needed to sustain collaborating scientists' participation in meetings and workshops. Training of scientists to carry out the collaboration is a very important aspect of networking. Funds should be made available from outside, especially if training is in another country.

One of the objectives of the network scheme is to assemble a critical mass of scientists from national and international research centres and focus their work on major problems. Collaborators must have sufficient training and expertise in order to make a contribution. Willingness to collaborate is not enough. The caliber is more important. Not all of the collaborators are of the same scientific strength, but they should provide the guidance and effectively carry out their portion of the research task. There are limited well-trained senior scientists, so the younger scientists who are carrying out the research task should be provided with training.

The network must be guided by strong and efficient leaders or coordinators who have the confidence of the collaborators. Collaboration will not progress if the collaborators feel the coordinator is coercing them into a straight jacket research agenda or if they do not receive recognition for their contribution. The work of the coordinator is very delicate since the network represents a delicate web of relationships. The coordinator must preserve and strengthen the relationship between its collaborators through mutual respect, recognition and credit sharing.

A network coordinator should be appointed to assist the collaborators to carry out the research task, facilitate sharing of information, and coordinate the activities of the network. He should provide the link between institutions, provide technical backstop and feedback problems and research information to collaborating and non-collaborating scientists. Preferably, he should work full time and be assigned with one of the collaborating institutions. He should have enough travel funds to visit the research activities in the field.

Sharing of research information and methodologies is one of the most important activities of a network. Frequent communication among scientists is very important. Regular meetings or workshops should be organised.

Responsibilities for organising meetings and workshops should be rotated among institutions involved and decentralised.

The ultimate goal of any network collaboration is to solve the production problems and increase farmers' income. There should be a mechanism to disseminate the technology generated to farmers or the research and extension system of participating countries.

Methodologies developed should be shared with the research system of the collaborating institution and between institutions in a country. In other words, the collaboration should not end up with a publication but with farmer adoption.

COORDINATION

Networks involve several scientists of different institutions with different levels of expertise, social backgrounds and financial resources. The most important key to a successful network is good and efficient coordination of the activities at all levels. A coordinating unit is important in any network with a leader or coordinator. There is a need to identify a unit at different levels: at the international level that link different countries, and at the country level that link scientists from within or between institutions. The coordinator/ leader may be appointed or elected and is usually a scientist. He should be a good organiser, technically knowledgeable, a diplomat and love travelling. The coordinating unit must have an operational base with administrative and logistical support.

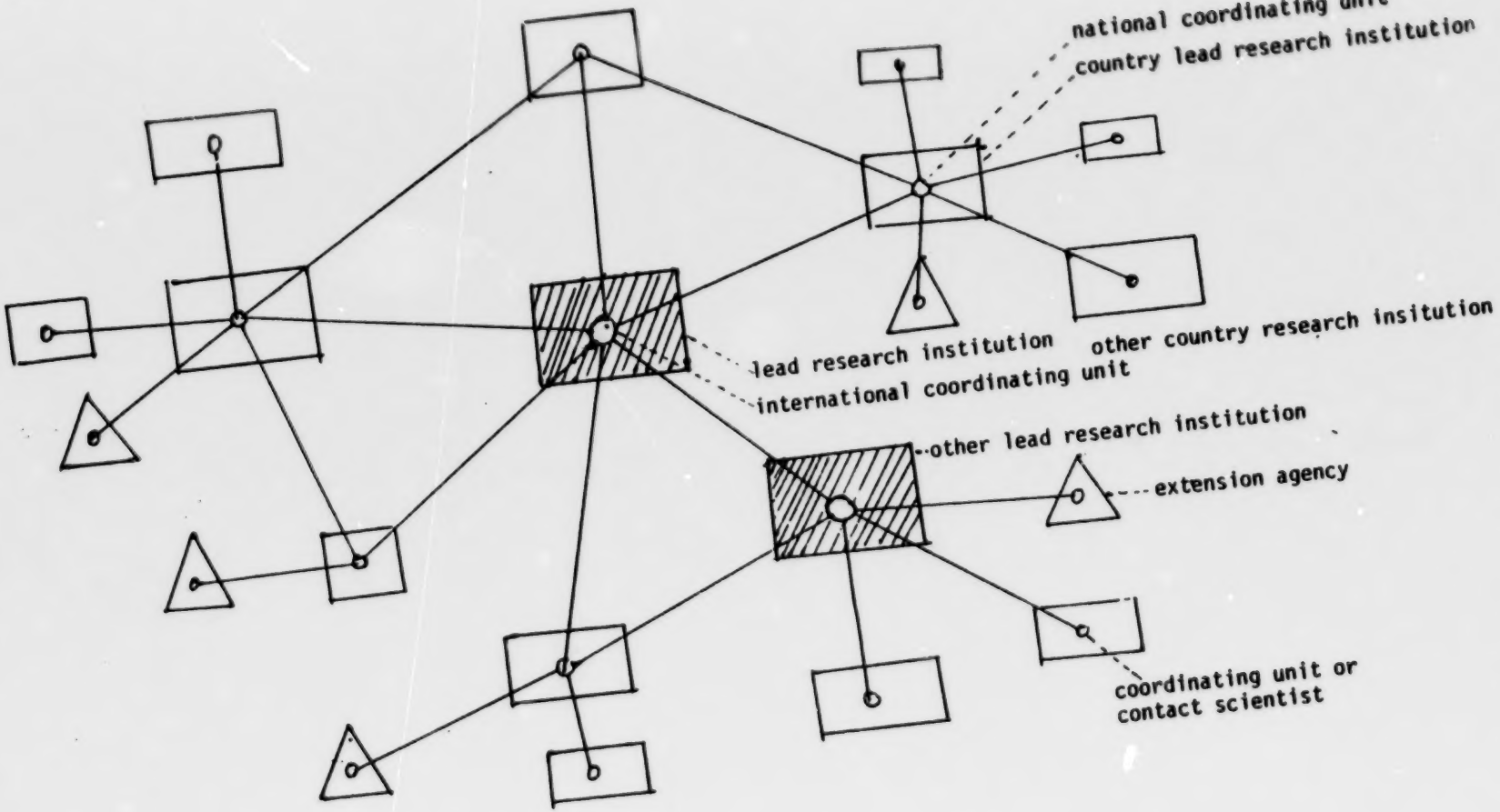
Shown in Figure 1 is a model for an international research network showing linkages between the central coordinating unit lead research institutions and national research institution and extension agency. The international coordinating unit must be located in one of the well-established research institutions represented. The lead institution should conduct research with international implications andprovide technical backstopping to national programs. In addition, other research institutions can be identified to conduct research with international implications and provide technical support to collaborating scientists. Each collaborating country should organise a coordinated research program involving scientists within an institution where the coordinating unit is located or other research institution in the country. The variation in size of the square indicates that collaborating institutions do not have the same amount of input into the network activities. Contact between national programs is either through the international coordinating unit or directly between national programs. The output of the collaborative research should not end up into just a publication. It should be disseminated to farmers through the extension agency.

A committee or working group should be organised at the international and national levels. Each country should be represented in the committee or working group. They can be regular members or invited participants during committee or working group meetings. Each country should have a local committee/working group with a coordinating unit. The members of local committees or working groups should be scientists from within or different research institutions. The chairman or head of a local coordinating unit should represent the country in the international committee or working group. This will ensure active participation of concerned local scientists and the research agenda is part of the national goal.

The coordinating unit should share responsibilities of the activities with the collaborators. A good international network is one where eventually national programs can carry out the coordination and research activities, even without the international coordinator. Some key scientists can be designated to help in the coordination. In ARFSN, national forage crop, animal and aquaculture scientists from national programs help in coordination. Encourage more participation of senior scientists involved in the network in decision making and technical backstopping.

FIGURE 1

GENERAL MODEL OF AN INTERNATIONAL RESEARCH NETWORK



Coordination is necessary with other networks that have similar objectives but are organised by different institutions. The proposed network on small ruminants should coordinate with the ARFSN (on crop-animal farming systems research), the Forage Crop Network of CIAT, the Alley Farming Network for Tropical Africa, Pan African Small Ruminant Collaborative Research Network, the Pasture Network for Eastern and South Africa, the Africa Research Network for Agricultural By-Products and others. I am sure there are similarities in some activities and each one can benefit from the other. Coordination can be done by organising joint meetings and workshops, sharing methodologies and technologies, free exchange of publications, inviting coordinators in the annual committee or working group meetings, and inviting scientists to workshops and meetings.

Coordination cannot be done by sending letters. There should be frequent contact by the coordinating unit with collaborators. The coordinator must visit occasionally to provide technical assistance, follow up implementation of research activities, promote linkages between interdisciplinary/intercommodity scientists, coordinate with administrators and boost the morale of participating scientists.

FUNDING OF NETWORKS AND COLLABORATIVE RESEARCHES

Funds must be available for the coordinating unit and additional support to augment the limited resources of collaborating scientists. The network schemes are attractive to many donor agencies since it is an efficient way to determine priorities in a country and the region. It is a good way to link the efforts of the IARC and other international research centres to national programs and reorient priorities of national programs to solve more relevant problems of small farmers. It is a means of coordinating the efforts of donor agencies in the region and in each country.

Most existing networks are funded separately, especially in IARC. For example, the IRTP is funded by UNDP and partly by the IRRI core. Testing nurseries in more than 80 countries are funded by the national programs and some are part of projects funded by donor agencies to the country programs. The ARFSN is more complicated. It is funded by national programs and many donor agencies. The coordinating unit is funded partly by IRRI, IDRC and others. In addition to support of national programs, the women in rice farming had additional support from IDRC, FAO, DANIDA, Ford Foundation, Rockefeller Foundation, and USAID; the crop-animal farming systems from IDRC and USAID; the data management from IDRC and SEARCA; varietal testing of upland crops from IDRC and USAID; cropping pattern testing from IDRC, USAID, EEC, IFAD, CIDA and World Bank; rice-fish farming from IDRC, ICLARM, and ADB; and prosperity with rice from ADB. The coordinating units have no control of the research funds except for coordination purposes. All are directly given to the collaborators, either as a project or part of a bigger project or program. In some cases, the networks help in getting the funds.

Training funds should be available to the coordinating unit to sustain the support to the training of collaborating scientists. In addition, training funds should be included in the country projects to ensure slots for training.

Most international centres have limited funds for training in support of the network activities. For example, IRRI have core funds for different kinds of training. It is augmented by additional support from donor agencies such as UNDP for GEU training and IDRC for farming systems training. About 30-70% of the trainees are funded by their own projects.

Funding should be provided for participation of international meetings, workshops, monitoring tours, and international travel of selected scientists to help the coordinating unit backstop the collaborators. Most country programs have no budget for international travel. In ARFSN, the coordinating unit has funds for sharing information which is part of the IDRC support to the coordinating unit. During meetings, monitoring tour and workshops, about 20-30% of the participants are funded by the coordinating unit, the rest by their own projects and national government.

PROBLEMS OF NETWORKING

There are many problems in networking, since it involved many institutions, disciplines, and different scientists. The more common ones are the following:

1) In international nurseries, an enormous number of entries are included. Trials are set for so many entries for wide adaptability that even those that are not relevant to their environment are included.

2) Design of experiments are often times done by selected few scientists. There is not enough time during workshops and meetings to properly discuss the design and data formats.

3) There are quarantine bottlenecks, especially in the introduction and evaluation of crops and animal breeds. Some of the seed deteriorate in government warehouses. Even when paperwork is all filled out, still quarantine clearance can be slow.

4) Feedback from collaborators is often slow. There is always a need for constant follow-up. In international nurseries less than 60% of the trials are returned.

5) Data collection is very important to explain performance in a given environment. Collaborators have difficulties collecting detailed data prescribed even if they are involved in the design of the format because of lack of trained manpower and computer facilities.

6) Research that requires interdisciplinary and intercommodity often have problems because of the organisational set-up of the collaborating institutions. Since only the project leader participates in the decision making, interdisciplinary work at the national level has problems.

7) The leadership issue is always a problem. Who will represent in the committee/working group, especially if several institutions in a country are involved? The coordinator or the representative to

the committee should be able to work with all the collaborators and administrators within a country.

8) Often, critical mass of well-trained scientists in the country is not available. The leaders are generally administrators and busy with other activities. The junior scientists are actually conducting the experiments.

9) Newsletter or exchange of publications is one of the most important activities of a network. Collaborators, especially scientists from developing countries, have problems sending information for publication and distribution.

10) Funding is always a problem. It is important to have sufficient funds to supplement funds of collaborators.

11) Data are always slow in reaching the coordinating unit. Sometimes there are missing observations. Some are difficult to interpret because the experimental design or methods differ among members.

ACRONYMS

AARD	Agency for Agricultural Research and Development
ACIAR	Australian Centre for International Agricultural Research
ADB	Asian Development Bank
ARFSN	Asian Rice Farming Systems Network
ASEAN	Association of South Eastern Asian Nations
AVRDC	Asian Vegetable Research and Development Centre
CAAS	Chinese Academy of Agricultural Sciences
CIAT	International Centre for Tropical Agriculture
CIDA	Canadian International Development Agency
CIMMYT	International Centre for Maize and Wheat Improvement
CIP	International Potato Centre
DANIDA	Danish International Development Agency
EEC	European Economic Community
FAO	Food and Agriculture Organisation
ICLARM	International Centre for Living Aquatic Resources Management
ICAR	Indian Council for Agricultural Research
ICARDA	International Centre for Agricultural Research in the Dry Areas
IDRC	International Development and Research Centre
IFAD	International Fund for Agricultural Development
IITA	International Institute of Tropical Agriculture
ILCA	International Livestock Centre for Africa
ICRISAT	International Crop Research Institute for the Semi-Arid Tropics
IRTP	International Rice Testing Program
IRRI	International Rice Research Institute
MARDI	Malaysian Agricultural Research and Development Research Institute
PARC	Pakistan Council for Agricultural Research
PCARRD	Philippine Council for Agricultural and Resources Research and Development
USAID	United States Agency for International Development
UNDP	United Nations Development Program

PRIORITIES FOR RESEARCH AND DEVELOPMENT ON SMALL RUMINANTS IN BANGLADESH

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ABSTRACT

Small ruminants substantially contribute to the landless and marginal farmers of Bangladesh. Goats provide 19% and sheep 0.58% of total meat while 28% of the country's milk supply comes from goats. Inspite of that, no visible improvement could be made because of lack of urgency and poor investment in research. Research on these small ruminants is very limited and the National Agricultural Research Plan in 1984, set up research priorities. These research has to be executed by the Bangladesh Livestock Research Institute (BLRI), but its manpower and research facilities are yet to be created. Some sporadic research work in goats has been done by University teachers. Facilities for documentation and exchange of information are lacking. Recently, Regional Centre Network for Agricultural Information within the SAARC member countries has been established at Bangladesh Agricultural Research Council (BARC) Dhaka. In the near future, this facility might be of great help for the researchers and academicians.

INTRODUCTION

Livestock constitutes an important supportive component of the farming systems in Bangladesh and it contributes substantially to the national economy providing draft power and animal food for human consumption. Inspite of this, the Livestock Sector does not receive due attention appropriate to its importance. It is one of the weakest sector of Bangladesh Agricultural Division. No visible improvement could be made in this sector because of lack of urgency and poor investment in research.

Goats and sheep have been treated as neglected species among livestock in Bangladesh although goats alone contribute about 19% of the total meat production. No research policy has so far been made at national level to exploit the potentiality of goat and sheep. Summaries of the small ruminant situation in Bangladesh have recently been reported (Saadullah and Das, 1986; Rahman, 1988).

CURRENT GOAT AND SHEEP POPULATIONS AND TRENDS

The total population of goat and sheep together of about 14

million (Table 1) is owned by about 40% of households (1983/4). Goats alone account for about 13.6 million heads with a distribution pattern of 98% in the rural areas and 2% in the urban area. Sheep population is only 0.524 million with distribution of pattern 99% in the rural area and 1% in urban areas. Since the previous census in 1977 sheep and goat numbers have increased at a rate of 3% per annum which is faster than for other livestock. The most important reasons for the higher rate are low investment capital needed, small size relative to cattle, higher prolificacy and good demand for goat meat.

TABLE 1. LIVESTOCK POPULATION (10^3)

Species	1977	1982-84
Cattle	20509	21495
Buffalo	469	567
Goat	8436	13558
Sheep	508	667

Source : Livestock Economist Section
Directorate of Livestock
Services, Bangladesh
(1983-84)

ANIMAL PRODUCTS AND BY-PRODUCTS

Livestock have been an integral part in the farming systems for centuries and it is considered the backbone of Bangladesh Agriculture. They are associated, in many different ways, with the life and well being of about 85% of the countries population, lives in the villages. Supply of protein rich food such as meat, milk and eggs is an important source of small farms cash income. Livestock by-products such as hides, skins and bone also contribute substantially to the foreign exchange earning of the country and thus have a sizeable share in the national economy.

Accurate data on meat production by the goats and sheep are not available, but are estimated. It is estimated that goats produce about 70,000 tonnes of meat per annum or 19% of total meat production.

Small ruminants, particularly goats, are milked, but there is no available information about sheep milking in the country. 28% of the total milk from Livestock is reported to come from goats (Saadullah and Das, 1986).

Bangladesh earns a handsome amount of foreign exchange through the export of Black Bengal skins and there is an overall increase of goat and sheep skins since 1980.

By-products are clean, sound and properly dressed edible parts other than meat, and have considerable value. However, some by-

products such as blood, hooves, ears, feet and scraping of the meat cuts are discarded by poor methods of slaughter and absence of any grading of meat and by-products.

Hair from goats is mostly used in making brushes of different kinds. In Bangladesh, wool and skin from sheep are considered as by-products by farmers, so 75% of the sheep remain unclipped each year. A small amount of hairy wool is available from tanneries.

BREEDS

Goats

The Black Bengal breed is really the only breed in Bangladesh although a few crossbred animals exist in some areas. It is a very popular and useful breed, and is widely distributed. It is well adapted and considered mainly as a meat producing animal although small in size. The most outstanding feature of Black Bengal is its prolificacy, multiple births are common. They usually kid twice a year. Some Jamnapari and their crosses are now available in the northern and north-western districts of Bangladesh.

It is an early maturing breed and usually give births to first kids by 15 months of age. Its milk yield is very low which is not often enough to meet the requirements of kids in case of twins or triplets.

Lactation length varies from 90 to 120 days, average milk yield is 25 kg and varies from 18 to 30 kg. Meat is excellent and highly palatable. It produces a skin of superior quality, which is in great demand both at home and abroad.

Sheep

Sheep available in Bangladesh are indigenous or of the non-descriptive type. They are primarily raised for mutton production. They produce mutton of superior quality. Average dressing percentage ranges from 42 to 48%. They produce a hairy type of fleece with an average yield of 300 to 500 gms annually per head but they are usually not shown. Milk yield is negligible and often not enough for the lambs in case of multiple birth. Like the Black Bengal breed, Bangladesh sheep are also very prolific. Ewes lamb twice a year producing twins or triplets during each lambing. The ewe lambs mature early and age at first lambing is generally found to be within 12 to 14 months. They are small sized animals having average mature body weight from 25 kg per ram and 18 kg per ewe.

RESEARCH PRIORITIES

Research work on sheep and goats has been very limited despite the potential for development. From a fairly large list of topics, the following have been considered to be of high priority :

1) Development of improved management practices and housing within the economic resources of the village.

2) Studies of socio-economic aspects of sheep and goats production and marketing.

3) Parasitic diseases and epidemiological studies of important diseases.

4) Feed resources and utilisation.

5) Investigation on possibility of developing dairy goats for small farmers.

RESEARCH TOPICS

Very little effective research work has so far been conducted for sheep and goat development in Bangladesh. As a result, information is poor on the different parameters of economic importance in sheep and goats.

In recent years, a few experiments and surveys have been conducted financed by the Bangladesh Agricultural Research Council, BARC, and by the Bangladesh Agricultural University, BAU. Some of these are :

1) Research on the reproductive performance of goats (Ali, 1978; Hossain and Hasnath, 1989).

2) Rate gain of kids at different ages and under various conditions.

3) Surveys in villages concerning ownership of small ruminants, mortality of kids and mature goats, feeding and management practices (Haque and Rahman, 1983).

4) Effects of urea treatment of straw.

5) Improvement of wool in sheep by crossing with exotic breeds (Huq et al., 1986; Rahman et al., 1978).

INSTITUTIONS AND PERSONNEL INVOLVED (numbers)

In Bangladesh, Livestock Research Systems involves three ministries and several organisations. The National Livestock Research System consists of a complex of institutions, centers, faculties of the Agricultural University. There are three institutes : (1) Animal Husbandry Research Institute, Comilla, (2) Veterinary Research Institute Dhaka, (3) Livestock Research Institute, Mohakali, Dhaka, each under the Directorate of Livestock Services. They are mostly engaged in producing vaccines and diagnosing diseases. There is a Central Cattle Breeding Station at Savar engaged in Cattle Breeding Research.

The BLRI was established at Savar in 1984 to concentrate research efforts on solving problems that hinder the growth and development in the farming systems of Bangladesh. Bangladesh Agricultural University through its various departments under the Faculty of Animal Husbandry and Faculty of Veterinary Science also conduct research. In addition, the scientists of these two Faculties are conducting some research projects with financial support of foreign donors such as UNICEF,

DANIDA, Rotary Foundation of Rotary International, IDRC and World University Service (WUS). These projects are mostly applied, field oriented and extension type. The total number of manpower involved in the livestock research is 276 but the number specifically in small ruminants has not been clearly established.

BLRI is a multi-disciplinary organisation developed on a problem oriented research program basis. It has five research divisions :

1) Systems Research

2) Ruminant and Poultry Production

3) Ruminant and Poultry Health

4) Socio-economics, and

5) Support Services

DOCUMENTATION AND INFORMATION EXCHANGE

Information Services in the field of research and development of livestock are of prime importance to scientists. Research materials such as journals, reprints, reports etc are rarely available in the different libraries of the country. Audio-visual aids, such as microfiche slides, overhead projector are not available in the library, where the scientists can get and enjoy full facilities of these aids. BARC and BAU should play a vital role in arranging these facilities for research. Institutional linkage within and outside the country are highly needed to improve these documentation and information services. Recently, the following programs has been taken by the government to:

1) Collect, process and store in standardised hard copy, microfiche and computerised data banks, all conventional and non-conventional documents and quantitative data relevant to Bangladesh.

2) Collection and preservation in standard form, information on agricultural and resource management activities.

3) Establish a network by linking the agricultural information and documentation centre and libraries in Bangladesh.

4) Establish the BARC information centre as the regional centre of a network for agricultural information exchange with an SAARC member countries.

5) Compile and disseminate bibliographies on topics relevant to the Bangladesh agricultural system throughout SAARC and BARC networks and related institutions.

6) Prepare agricultural information for a mass media and audio visual outlet within BARC agricultural information centre.

7) Publish journal, newsletter, analytical bibliographies, directories, bulletins, audio-visual materials, policy briefs and forecasts on agriculture activities.

8) Provide training and agricultural information sciences within the SAARC and BARC agricultural information networks.

CURRICULA AND TRAINING

BAU is producing two types of graduates, namely Doctor of Veterinary Medicine (DVM) in the Faculty of Veterinary Science and the B.Sc. Animal Husbandry degree is offered by the Faculty of Animal Husbandry. Doctor of Veterinary Medicine graduates are directly concerned with the treatment, prevention and control of diseases of Livestock and Poultry and the Animal Husbandry graduates are purely concerned with production of livestock and poultry.

In addition, both these faculties are also offering courses for M.Sc. and Ph.D. degrees in their respective fields.

Training

The most critical resource of any research oriented organisation is its personnel. The organisations can be successful only to the extent that it hires and retains high quality staff and provides them with a rewarding and stimulating work environment. There is insufficient trained manpower in the livestock sectors in Bangladesh. According to Agricultural Research Inventory (1978), only 2% of the total technical personnel engaged in the agricultural research concentrated on the livestock sector. Therefore, in order to meet the new challenge in livestock research and development, a comprehensive national program for training manpower is urgently needed.

In Bangladesh, there are some agricultural sectors especially crops, where there is sufficient trained manpower available, whereas, sectors like livestock and fisheries trained manpower availability is far from the requirement.

FUTURE RESEARCH DIRECTION

In the recent past, the Government of Bangladesh has set up in institution, for research and development of livestock and poultry in the name of BLRI. It is still in infancy stage, its infrastructures are yet to be developed. Manpower are yet to be recruited and trained. Facilities are yet to be created. BAU has started doing some fundamental research on small ruminants in addition to teaching within its limited resources. Coordination needs to be developed between the scientists of BAU and other organisations like BARC and BLRI.

Future research direction depends on the financial and support likely to be forthcoming. From past experience, this is likely to be limited. Research is needed over the whole range of sheep and goats production. Some indication of research priorities have already been given but research on improving the nutrition, and primitive systems of husbandry, high incidence of diseases, especially internal parasites, need to be undertaken immediately. Research practices need to be directed for improvement of meat production, reproductive efficiency and economics of rearing small ruminants by the small farmers.

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THE PRESENT STATUS AND FUTURE OF SMALL RUMINANTS IN CHINA

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ABSTRACT

The paper traces the long history of sheep and goats in China, including the more recent introductions of fine wooled breeds, Rambouillets, Merinos and Corriedales and the development of the Chinese-fine wool sheep. It is estimated that the present population is 110 million sheep and 90 million goats, comprising 22 sheep and 20 goat breeds. The wool, meat, pelt and other products are described. Research priorities are listed.

INTRODUCTION AND HISTORICAL ASPECTS

China was one of the earliest countries in sheep husbandry with records traced back to over 3,000 years ago. It was reported in ancient records that many sheep breeds were established as early as Tang Dynasty (618-907 AD) including Hexi, Hedong, Shayuan (now Tongyang sheep) and Manyang (now Tibetan) sheep. All these breeds produced outstanding wool for making carpets famous for their typical oriental style for the royal families, and the carpets were exported to Afghanistan and India.

Some of the sheep breeds such as the Huyang were for lamb skins. Both the Huyang sheep in Zhejiang and Jiangsu and Hanyang sheep in Central China area were very productive and prolific.

Sheep improvement by introducing foreign blood first started in 1914. Rambouillet Merino sheep imported from the USA and sheep farms were set up for the purpose of improving the local breeds in wool production.

More Rambouillets from U.S.A. were imported in 1920 to improve the local coarse wool sheep in Shanxi Province. Heavy losses of improved sheep occurred during the Japanese occupation but after the Second World War, UNRRA (United Nations Relief and Rehabilitation Administration) helped China to import several thousand Corriedale sheep, and breeding farms were established in Gansu, Zhejiang, Jiangsu and Shandong for crossing with the local breeds.

In 1934, Xinjiang imported a group of fine wool sheep from the USSR, such as Caucassian and Precoce Merinos. These breeds were placed in different areas of Xinjiang to cross with the local Kazakh and Mongolian sheep and this played an important role in the fine-wool sheep development. By 1943, the whole Xinjiang area had 28,000 crossbred sheep.

After the founding of the People's Republic of China (P.R.C.), more detailed work has been done on sheep breeding. In 1954, the Ministry of Agriculture announced the establishment of the first fine-wool sheep of China - Xinjiang Fine Wool Sheep. There were only about 50,000 sheep of the breed when it was first established. But by the end of 1988 the total population of Xinjiang Fine Wool Sheep reached over 10,000 head with 37,000 tonnes of fine wool production. And over 400,000 head of fine wool sheep were sold to other parts of the country for both breeding and production. Xinjiang Fine Wool sheep has the largest population among all fine wool breeds in China.

BREEDS

In China, sheep are mainly distributed in the dry areas of the temperate and cold-temperate zones around 30° to 45° north latitude. Very little sheep can be found in the high humidity and high temperate areas.

As for goats, they are widely distributed in all parts of China and exceed the number of sheep more in the south than the north, in the coastal rather than in-land areas, and in the agricultural area rather than the animal husbandry area.

There are 42 sheep and goat breeds described in the **Sheep and Goats Breeds of China** (1989) comprising 22 sheep and 20 goat breeds.

The coarse wool sheep can be grouped into three types : Mongolian, Tibetan and Kazakh. According to their products, breeds can also be grouped as fine wool sheep, semi-fine wool sheep, carpet wool sheep, prolific type of sheep and pelt and lambskin type. Carpet wool sheep make up 40% of the total. Fine wool sheep, semi-fine wool sheep and other crossbred sheep also make up 40%. Prolific type sheep contribute 2% of the total sheep population, and include the Huyang, Small-tail Hanyang, and Big-tail Hanyang. Lambskin and pelt type sheep such as the Tanyang and Karakul also make up 2% of the total. The remainder would be meat and fat type, such as the Wujumqin and Altai Fat-Rumped sheep.

Out of the goat breeds, cashmere goats make up 48% of the total. Milk goats only 1.6%, pelt and kidskin type 1.5%, pen-brush type 1% and the rest would be hide/meat type.

Of the goat breeds, the most famous cashmere goats are Liaoning Cashmere Goat and Inner Mongolian Cashmere Goat, which are located mainly in Liaoning, Inner Mongolia and Gansu. As for the milk goats, there are Guanzhong Milk Goat, and Laoshan Milk Goat, which are located mainly in Shaanxi, Shandong and Hebei.

The famous prolific kidskin type goat is the Jining Grey Goat which is located in Jining and Heze area of Shandong Province as well as the adjacent provinces. Zhongwei goat is well known for its beautiful fur and is located in Ningxia and Gansu provinces. Pen-brush type goats are mainly located around the Taihu Lake in Jiangsu and Zhejiang provinces, while the best quality hides can be found in Sichuan, Henan, Anhui, and Hubei provinces.

SHEEP AND GOAT PRODUCTS

According to the statistics at the end of 1988, China has a sheep population of over 110 million, and a goat population of over 90 million, totally 200 million. The mutton production 800,000 tonnes; wool production 220,000 tonnes including 110,000 tonnes of fine wool and 44,000 tonnes of semi-fine wool and other crossbred wool; cashmere production 4,000 tonnes and goat hair 14,000 tonnes.

Wool Production For Textile

In order to meet the needs of the economic development of the country, steps were taken to introduce fine wool and semi-fine wool stud sheep as sires to cross with the local coarse wool sheep to improve the wool quality and to increase the wool production.

In the early 1950's, a large number of fine wool and semi-fine wool sheep were imported from USSR. From 1960's to 1980's long wool sheep, Corriedale sheep, and Merino rams were imported from England, New Zealand and Australia respectively.

The central government and the local governments made joint efforts to invest on the setting up of sheep studs in the main sheep growing areas to speed up sheep improvement through wide range of artificial insemination. Xinjiang and Inner Mongolia are the main fine-wool sheep producing areas. The production of fine wool and other crossbred wool in 1988 made up 34% and 26% respectively of the national wool production.

Cashmere Production

Steps have been taken to make further selection of the breed and to cross with better breeds so as to improve the individual production and the quality of the cashmere. Inner Mongolia is the main cashmere producing area.

Carpet Wool Production

Considerable efforts have been made to undertake breed selection and cross breeding to improve wool quality and individual wool production. The best carpet wool is produced in Xining and Hetian areas which provide the main raw material for "orient carpet". The annual production of various kinds of carpet is over 5,000 m^2.

Fur and Lambskin/Kidskin Production

The Huyang lambskin and the grey goat kidskin are well known for their water-wave-like curls. Those are the best type of lamb and kid skins for making lady's fur coat fashions famous for being light, beautiful and tasteful. The Tanyang sheep and Zhongwei goat produce the best quality Ermao Lambskin (30/60 days) characterised for being light, warm with fair curls, suitable for both men and ladies.

Sheep and Goat Pelt and Hide Production

In recent years, there is a rapid development in sheep and goat pelt and hide production. The ready products and semi-finished

products of coats, boots, shoes, and shorn-pelt products are popular for both international and home market.

Meat Production

Mutton has been the main meat product of sheep in China. Prime lamb production is on a limited scale, but will be encouraged through housing and feedlotting systems.

GENERAL POLICIES TO IMPROVE PRODUCTION

The following strategies are suggested to further develop the sheep and goat industry and to improve product quality :

1) Develop the type and number of animals according to adaptation to local conditions by selection.

2) Expedite breed improvement through selection on recorded performance making full use of imported and local studs through artificial insemination.

3) Improve the distribution, commercial and marketing aspects of production.

4) Develop improved pastures on the grazing lambs.

5) Develop crop-livestock systems and especially the utilisation of crop residues.

RESEARCH PRIORITIES

1) Study on production performance on following breeds :

   - Prolific sheep breeds : Huyang and Hanyang
   - Prolific goat breeds : Grey and Huai
   - Pelt breeds : Tanyang sheep and Zhongwei goat
   - Pen-brush breed : Haimen goat

2) Production systems for small ruminants especially from traditional systems to intensive systems and the integration of sheep and goats with cropping in the agricultural areas.

3) Breeding and selection for improving sheep and goat productivity and the quality of product. The application of advanced techniques to improve breeding.

4) Integration of feed supplies, pasture and crop residues, to meet the nutritional requirements and achieve maximum production.

5) Foreign aid programs to create research centres.

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PRIORITIES FOR RESEARCH AND DEVELOPMENT OF SMALL RUMINANTS IN INDIA

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ABSTRACT

India has about 95 million goats and 55 million sheep. It has a large number of indigenous breeds of both sheep and goats. This paper summarises the very large extent of small ruminant research which has been and in now being carried out in India but is restricted by space to dealing only with the major areas of research. The main centre of sheep and wool research is in the Central Sheep and Wool Research Institute, Avikanagar, Rajasthan, and research on goats is carried out at the Central Institute for Research in Goats in Makhdoom. There are also coordinated research projects on sheep and goats and a large number of universities conducting research on small ruminants. Postgraduate training courses in small ruminants are conducted at several institutes.

INTRODUCTION

Small ruminants, sheep and goats are numerically important domestic animals in the arid and semi-arid regions of India. These animals are primarily raised in a traditional manner, and there is little organised effort for their improvement. They are maintained by small and marginal farmers and landless labourers who are economically and socially backward. Further, these animals are primarily raised on natural vegetation and crop stubbles supplemented with tree loppings. These species breed throughout the year and there is little control of the breeding. Productivity is relatively low compared to that in more agriculturally advanced countries, but considering the nutritional, physical environmental and health constraints, the productivity cannot be considered as inefficient.

There has been a serious controversy on the role of these two species in desertification and policies are being framed to remove these species from ecologically fragile zones where they currently predominate. It is unfortunate that the role of small ruminants in ecological degradation and in meeting the economic needs of the rural poor has not been fully evaluated. The observations and results of systematic studies carried out in India do show that the small ruminants are no more destructive to the natural vegetation than other species of livestock and are more economical, especially goats, in environmentally and nutritionally difficult ecologies, goats especially.

Referring specifically to sheep, an account of their production in India has recently been reported by Patnayak (1988).

CURRENT GOAT AND SHEEP POPULATIONS AND TRENDS

According to the 1982 census, the population of goats in India was 95 millions. The FAO estimate for the year 1986 (FAO, 1987) indicate the population to be 103 millions. The population of goats has shown a large increase during 1951 to 1982. The overall annual rate being 3.2% which is higher than for any other livestock species in India except pigs.

According to the 1982 census, the sheep population was 49 millions. The FAO has projected the population in 1986 (FAO, 1987) to be 55 million. The population of sheep has essentially remained static at around 40 million from 1951 to 1977. The major increase in population has been from 1977 to 1982.

PRODUCTION

According to FAO (1987), goats provided annually 1.0 million tonnes of milk, 0.370 million tonnes of meat and 0.076 million tonnes of skins. The annual off-take of goats is estimated to be around 36.5 and the average dressed weight is 9 kg. The current annual production from sheep is 47 million kg of wool and 0.152 million tonnes of meat. The annual offtake in sheep is around 32.5%. The contribution of sheep to milk is rather small and is not recorded. Similarly, the production of fibre both in terms of pashmina (cashmere) and goat hair is not being recorded. However, the two are economically important.

BREEDS

Acharya (1982) has reported a description of the Indian breeds of sheep and goats. There are 40 described breeds of sheep and 20 of goats. More are being added. In spite of such a large number of breeds, the majority (75%) of animals of the two species are non-describable. There is a large intermixture amongst breeds in regions where two or more breeds exist. There are no breeding societies or agencies to register animals of a particular breed, maintain flock books and ensure the purity of a breed or type. Little systematic effort has been made to describe, evaluate, conserve and improve the indigenous breeds. There do exist a few Central and State Government Breeding Farms which maintain flocks of indigenous breeds mostly of sheep for production of studs for distribution to the farmers. Most of the breeds of sheep and goats in India have evolved through natural selection for adaptation to agro-ecological conditions and very little directed effort for developing these breeds through artificial selection has been made. These breeds are very well adapted to a harsh climate, long migration, poor nutrition and little drinking water.

Based on the agro-climatic conditions and the type of sheep and goats, the country can be divided into four regions :

1) Northern temperate : comprising States of Jammu and Kashmir, Himachal Pradesh and hilly regions of Uttar Pradesh.

2) North Western arid and semi arid region : comprising States of Rajasthan, Punjab, Haryana, plains of U.P., Gujarat and Madhya Pradesh.

3) Southern Peninsular region : comprising States of Maharashtra, Andhra Pradesh, Karnataka and Tamil Nadu (semi arid in the central peninsula and hot and humid along the coast).

4) Eastern region : which is mostly hot and humid comprising States of Bihar, West Bengal, Orissa, Assam and other North-East States.

The breeds of sheep and goats in these four regions are given in Table 1.

DEVELOPMENT INFRASTRUCTURE AND EFFORT

The Government of India has supported programs for sheep development on a regional basis involving crossbreeding with exotic fine wool, mutton and dual-purpose breeds, grading with superior indigenous breeds, and selection within better indigenous breeds. For this purpose, the Central and State Governments have established sheep farms with exotic and indigenous breeds for production of stud breeding rams. Some effort for producing bucks of superior indigenous breeds on government farms and their placement in veterinary hospitals for natural service have been made. More recently, intensive sheep development projects and sheep and wool extension centre have also been established for providing integrated inputs and services eg. breeding and health cover and machine shearing facilities have been taken up. Wool grading and marketing centres were also established. Some states have separate departments of sheep husbandry and Cooperative Sheep and Wool Board/Federation for providing services and taking up marketing of live animals and wool.

RESEARCH PRIORITIES AND DIRECTIONS

Genetic Improvement

The research so far has been directed towards evolving new high-producing breeds incorporating the superior performance characteristics of the exotic breeds and adaptation characteristics of the indigenous breeds. The emphasis in sheep has been on evolving superior apparel wool, carpet wool, mutton, and lamb pelt breeds. In goats, major emphasis has been on evolving superior dairy and mohair breeds.

Nutrition

Nutritional studies have been carried out for determining nutritional requirements for different types and levels of production and physiological states, evaluating nutritive value of different feeds including natural and improved pastures and top feeds, role of supplementary feeding, and intensive feeding of animals especially for meat production.

TABLE 1. INDIAN BREEDS OF SHEEP AND GOATS

Region	Sheep	Goat
North Temperate	Gaddi	Gaddo
	Rampur Bushair	Chang Thangi
	Bhakarwal	Chegu
	Poonchi	
	Karnal	
	Gurez	
	Kashmir Marino	
	Changthangi	
North Western	Chokla	Sirohi
	Nali	Marwari
	Marwari	Jhakrana
	Magra	Beetal
	Jaisalmeri	Barbari
	Pugal	Jamnapari
	Malpura	Mehsana
	Sonadi	Gohilwadi
	Pattanwadi	Zalawadi
	Muzaffar	Kutchi
	Jalauni	Surti
	Hisardale	
Southern	Deccani	Sangamneri
	Nellor	Osman sibadi
	Bellary	Kannai Adu
	Hassan	Malabari
	Mandya	
	Mecheri	
	Kilakarsal	
	Vembur	
	Coimbatore	
	Nilgiri	
	Ramand white	
	Madras red	
	Tiruchy black	
	Kenguri	
Eastern Sheep	Chottanagpuri	Gangam
	Shahbadi	Bengal
	Balangir	
	Ganjam	
	Tibetan	
	Bonpala	

Reproduction and Adaptation

Research has been carried out on male reproduction related to effect of season on semen production and quality, preservation of semen and developing sound artificial insemination techniques.

In females, reproduction studies have been carried out on the effect of physical environment on expression of oestrus, optimum time of breeding, effect of management factors on rebreeding and determining optimum breeding season for maximising production. Studies on adaptation have been related to physiological responses to physical environment and their relationship with production, water deprivation and different watering regimens and their effect on nutritive digestibility and production, tolerance of salt water, effect of coat colour and coat type on physiological responses to physical environment in goats and their relation with production, and the causation of canary (yellow) colouration in autumn clip of sheep in the northwestern region.

Diseases

Research has been carried on epidemiology, diagnostic, prophylactic and treatment aspects of important infections and non-infectious and systematic diseases.

Evaluation of Products and Processing

Evaluation of wools involving their physical, chemical, mechanical, mechano-chemical and mechanical processing parameters for determining their end-use suitability have been carried out. Some studies on carcass yield, carcass quality and meat quality in relation to breed, age and weight at slaughter and sex have been carried out.

MAJOR RESEARCH ACHIEVEMENTS

Results of research in small ruminants have more recently been reviewed by Acharya (1986). These results under various research priorities indicated earlier are summarised below :

Genetic Improvement

a) **Sheep**

Studies of performance of Indian breeds of sheep for important economic characteristic have shown the Magra to have the best performance and it has been used for improving carpet wool production and quality in coarse and hairy wool breeds in all the regions. In the Southern peninsular region, the Nellore is the tallest and heaviest breed and has been used for improving mutton production in non-woolly breeds.

Selection criteria have been established to improve the important production characters - growth, wool weight and quality.

Grading up of coarse and hairy breeds such as the Deccani/Bellary with Magra has resulted in improvement of greasy wool production

and wool quality towards usable carpet wool.

Crosses of better carpet wool breeds with exotic fine wool breeds (Rambouillet and Merinos) have also shown improvement in greasy fleece production and quality. New fine wool breeds have been evolved utilising $^{1}/_{2}$ breds and $^{3}/_{4}$ breds as a base. Kashmir Merino Avivastra, Bharat Merino and new fine wool synthetics are the outcome of the evolutionary crossbreedings. Of these, the population of Kashmir Merino would be around 0.6 million.

Crossbreeding of indigenous breeds with exotic mutton breeds viz. Dorset and Sufflok has resulted in improvement in live weight gains and feed efficiency. Crossbreeding for pelt production involving coarse and hairy sheep breeds and Karakul has shown the $^{3}/_{4}$ breds to produce as good lamb pelts as purebred Karakul.

b) **Goats**

The performance of important indigenous breeds of goats for major economic characteristics has been determined. Results indicate that Jamnapari and Beetal can be utilised as improver breeds for increasing size and milk production.

Selection based on an index combining age at first kidding and first lactation yield is most efficient in bringing genetic improvement in lactation and reproductive performance.

Crossing of indigenous breeds with exotic dairy breeds has shown substantial increases in milk production and Saanen Crosses to be superior to Alpine crosses.

Crossbreeding for improving meat production involving superior indigenous breeds viz. Beetal and Jamnapari and medium and small sized breeds viz. Sirohi and Black Bengal has shown substantial improvement in small sized breeds in body weight gains. Beetal in general has shown better performance in crosses with other indigenous breeds.

Nutrition

Extensive studies on establishment and evaluation of rainfed pastures have been carried out at several institutes. Availability of adequate energy throughout the year and adequate protein for more than half of the year is limiting. Reseeding with perennial grasses and legumes can raise the carrying capacity up to five animals per hectare even to 10 animals and beyond with plantation of fodder trees and shrubs. Various fodder trees have been evaluated with respect to their fodder yield, palatability and nutritive value.

Nutrient requirement, in terms of TDN and DCP, for sheep at various bodyweights and physiological states has been worked out.

Reproduction and Adaptation

Protocols for deep freezing of buck semen have been developed with reasonable fertility rates. Similar techniques for super-ovulation and embryo transfer have been developed in goats. Work on long term preservation including cryopreservation of ram semen is in progress.

Work on the optimum breeding season in sheep in arid regions indicates that although animals exhibit oestrous throughout the year, it is desirable to breed them in March-April or August-September, the earlier season providing better performance in terms of lamb growth ad survival because of the better feed availability. It has been observed that indigenous sheep and goat breeds have much higher reproduction potential than is normally being exploited.

The influence of water deprivation, coat (fleece) type and other factors on heat tolerance of sheep and goats, both indigenous and crossbred has been measured.

Diseases

Work has been carried out on parasitic infestations both internal and external and the treatment of these.

Research on epidemiology, diagnosis and prophylaxis of important bacterial and viral diseases has also been carried out. Effective vaccines are available against sheep on goat pox and clostridial diseases. Blue tongue has more recently been introduced in the country and is resulting in serious morbidity.

INSTITUTIONS AND PERSONNEL INVOLVED

The Indian Council of Agricultural Research (ICAR), is the national coordinating and funding agency and supports inter alia programs related to small ruminants.

The major institutes involved in sheep and goat research are : Central Sheep and Wool Research Institute (CSWRI), Avikanagar, via Jaipur (Rajasthan) and Central Institute for Research on Goats (CIRG), Makhdoom, Farah, Mathura Distt. (UP). The ICAR is also supporting research on sheep and goat breeding under the All India Coordinated Research Project (AICRP) on goats for milk, meat and fibre and AICRP on sheep for wool and mutton. The centres of the project on goat for milk are/have been located at National Dairy Research Institute (NDRI) Karnal (Haryana), Kerala Agricultural University, Mannuthy (Kerala). Centres for goat for meat are located at CIRG Western Regional Station, Avikanagar (Rajasthan), Birsa Agricultural University, Ranchi (Bihar), Veterinary College, Mhow and College of Veterinary Sciences, Bikaner (Rajasthan).

Units on fibre are located at Goat Breeding Farm Upshi, Leh, Ladhak (Jammu and Kashmir), Indian Veterinary Research Institute (IVRI) Mukteschwar, Utta Pradesh and Mahatma Phule Krishi Vidyapeeth, Rahuri (Maharashtra).

The coordinated project on sheep involves two cites for wool, two for carpet wool and one for mutton, additional to CSWRI.

In addition to the ICAR Institutes and AICRPS, 26 State Agricultural Universities (25 of them have one or more colleges of veterinary and animal sciences), have research programs on improving sheep and goat production and health.

A total of 120 scientists at CSWRI and 60 scientists at CIRG are involved in small ruminant research. About 30 scientists in the coordinated project on goat and 30 scientists in the coordinated project on sheep are involved in research. Other institutes of ICAR viz. Indian Grassland and Fodder Research Institute (IGFRI), Jhansi, Utta Pradesh, Central Arid Zone Research Institute (CAZRI), Jodhpur (Rajasthan), North-Eastern Agriculture Complex (NEH), Shillong (Arunachal Pradesh) are involved in small ruminant research primarily with respect to the improvement of feed resources, adaptation to the specific ecologies and areas connected with their improvement. IVRI is involved in areas of health, particularly developing diagnostics and prophylactics measures. The NDRI in addition to breeding research has been involved in research on the areas of nutrition and physiology of goats and dairy processing technology of goat milk, National Institute of Animal Genetics (NIAG), Karnal (Haryana) is involved in basic genetic studies.

DOCUMENTATION AND INFORMATION EXCHANGE

The ICAR Institutes bring out their annual reports. In addition, the scientists working in these institutes publish their research papers in national and international journals. The coordinated projects bring out the Project Coordinators report and annual reports and each centre highlighting the research results. The ICAR produces the Indian Journal of Animal Science, Indian Farming and Kheti. The ICAR has all Agriculture Research Information Centre (ARIC) as a part of its Headquarters where research project files of the Institute research projects are maintained.

There is no dependable information exchange system except the circulation of the annual reports. There exists an Indian Society for Sheep and Goat Production and Utilisation, which brings out quarterly bulletin as well as organises annual meetings/conferences and brings out proceedings of such conferences.

CURRICULA AND TRAINING

The State Agriculture Universities, IVRI and NDRI conduct post-graduate training programs on various aspects of livestock production, health and products technology, some of them specifically pertaining to small ruminants. A number of other institutes conduct post-graduate courses in livestock production including small ruminants.

The CIRG and CSWRI organise, on demand, short term training programs ranging from three weeks to three months. The CSWRI conducts a nine-month post-graduate diploma course in sheep and wool production while short term training programs for the farmers are conducted at the institutes. ICAR supports summer institutes for teachers and research workers in various subjects also including small ruminants from time to time in ICAR institutes and State Agricultural Universities.

FUTURE RESEARCH PROGRAMS

Genetic Resource Evaluation and Conservation

To better understand our indigenous breeds, it is planned that the National Bureau of Animal Genetic Resources (NBAGR) in collaboration with CSWRI and CIRG, State Agriculture Universities and other State agencies will undertake extensive surveys of the indigenous breeds especially a number that are faced with extinction; to describe them in terms of physical conformation and body measurement, look into their performance in relation to physical environment, feed resources, management practices etc.

Genetic Improvement

Further studies on genetic improvement through selection in important indigenous breds and through crossing with superior exotic breeds will be made primarily for evolving new high producing and adapted breeds and grading of inferior indigenous breeds with superior indigenous breeds.

Nutrition and Feeding

Survey of feed resource available and their utilisation with major emphasis on non-conventional feed resources, development of low cost feeding systems both in extensive and intensive feeding situations, the latter for intensive milk and meat production. Research on feed processing will also be emphasised.

Reproduction

Development of protocols for freezing of buck and ram semen and for multiple ovulation embryo transfer and their utilisation in genetic improvement and genetic resource conservation.

Studies on adaptation of animal to physical environment and suitable amelioration methods through housing and grazing management.

Disease surveillance and monitoring with a view to develop more strategic control and eradication measures for important diseases.

Development of methods for quality evaluation of various animal products and their processing to add value, reduce bulk and increase shelf-life.

Study the socio-economic constraints in adoption of production technologies and integration of sheep and goat in various land use systems.

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PRIORITIES FOR RESEARCH AND DEVELOPMENT ON SMALL RUMINANTS IN INDONESIA

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ABSTRACT

The constraints in small ruminant production and development in Indonesia are physical, biological and socio-economic in nature, resulting in the existing smallholder production systems, low productivity and performance, high mortality, slow growth rates and low capital availability. Research and development programs in the past two decades have focused more towards providing solutions to technical and biological problems faced by the farmer. The development programs include the distribution of a small number of animals to individual farmers under a credit scheme with continual supervision in the transfer of technology being provided. The aim was to increase production, farmer's income, through intensive management and/or extensification of the production system. There is a growing need to increase the small ruminant productivity and production to meet the national as well as export demand, while emphasising the importance of implementing market-oriented research and development programs.

INTRODUCTION

In Indonesia, the majority of goats and sheep are raised in small numbers (3 - 4 heads per farm) by about 4.7 million farm holdings (estimated at around 20% of the total number of farmers), which is higher than those raising large ruminants, commercial poultry and pig operations (Knipscheer et al., 1983). The animals are kept for multi-purposes : source of quick liquid asset, manure, hides/skins. The production of milk and fibre are only important in a few areas and are relatively in low demand.

CURRENT GOAT AND SHEEP PRODUCTION AND TRENDS

Small ruminants are widely distributed throughout Indonesia but are heavily concentrated (60% of the population) in a few provinces of Java (Table 1), which coincides with the number and distribution of farmers. This suggests that raising small ruminants is important for

TABLE 1. DISTRIBUTION OF HUMAN AND SMALL RUMINANT POPULATION IN RELATION TO LAND AREA IN INDONESIA (1988)

Region or island	Land area (km^2)	Population (number/km^2)		
		Human	Goat	Sheep
Sumatra	473,606	59	0.96	3.7
Java & Madura	132,187	690	36.2	2.4
Bali and Nusa Tenggara islands	88,488	96	8.2	1.4
Kalimantan	539,460	12	0.3	1.6
Sulawesi	189,216	55	5.3	4.3
Maluku and Irian Jaya	496,486	5	0.6	1.7

the small farmer. The population of small ruminants in Indonesia is largest in the Asian region, and consists about 10.6 million goats and 5.5 million sheep (Table 2). Over the past five years (Pelita IV) the population increase has been about 3.5% per annum (3.29% for sheep and 3.73% for goats), which is relatively higher than that for cattle and buffaloes.

The widening gap between the production of meat (Table 3) in relation to the nutritional requirement, emphasised the need to place more efforts to improve and develop the livestock and poultry production. The contribution of small ruminants (93.6 thousand tonnes) to the total meat supply is relatively small (17.8% excluding meat from poultry), but remains stable over the past five years. However, the raising of small ruminants probably ranks second in the economic priority list of the farmer. During Pelita IV, the production of goat meat increased by 8.2% while that of sheep declined (- 0.20%) (Table 3). In the context of international trade, small ruminants have a bright future prospect and this may have motivated entrepreneurs to initiate a small ruminant business.

Hides and skins of small ruminants form important by-products for local use and more importantly, an export commodity. Sheep production in Indonesia has recently been described by Djajanegara and Rangkuti (1988).

BREEDS AVAILABLE

The major breeds of goats in Indonesia are the Kacang goat, and Peranakan Etawah (cross between the local and the Etawah/Jamnapari goat). The latter was believed imported from India to improve the genetic potential of the local goat for milk production. The Saanen goat was also introduced into Indonesia, however, at present there is little information on the adaptability of this breed when raised under the traditional management system.

TABLE 2. GOAT AND SHEEP POPULATION TRENDS
(10^3; 1984-1988)

Species	1984	1985	1986	1987	1988*	r
Goat	9,205	9,599	9,866	10,392	10,555	3.29
Sheep	4,707	4,885	4,980	5,364	5,445	3.75

* Preliminary figures,
Source : Directorate of Livestock Services (1989)

TABLE 3. PRODUCTION OF MEAT FROM LIVESTOCK AND POULTRY 1984-1988 (x 1000 tonnes)

	1984	1985	1986	1987	1988*	r
Total livestock	462.5	490.2	535.7	513.1	524.6	3.32
Goat	48.3	49.5	61.8	61.5	65.2	8.22
Sheep	28.8	29.8	31.7	30.6	28.4	-0.20
Total poultry	279.7	318.2	343.3	383.0	404.2	9.67
Broiler	78.5	114.5	139.2	174.6	188.6	25.2
Total meat	742.2	808.4	879.0	896.1	928.8	5.81

Source : Directorate of Livestock Services (1989)

The most important local breeds of sheep are the Javanese-Thin-Tail (JTT) and Javanese-Fat-Tail (JFT) sheep, and also the Priangan sheep, known as the Domba Garut which are mainly found in West Java (Mason, 1978). In 1975, temperate breeds of sheep from Australia i.e. Merino, Suffolk and Dorsets, and also crossing between Dorset X Merino and Suffolk X Merino have been introduced. Recently, the hairsheep (St. Croix - Virgin Island White) has been imported for research purposes.

While the production and productivity of the respective indigenous breeds have been documented in a number of publications, the proportion of the respective breeds to the total population is not clear.

RESEARCH PRIORITIES AND HIGHLIGHTS

During the past two decades, research on small ruminants has focused on the improvement of the productivity through improved management practices. Research programs aimed at establishing new technology that

are technically sound, economically feasible, socially acceptable and environmentally feasible, involving four major aspects namely :

1) Breeding/reproduction.

2) Feeding and nutrition.

3) Socio-economics.

4) Disease.

Breeding/reproduction

Programs to evaluate and characterise the production potential of the existing indigenous breeds of sheep and goats in Indonesia have been given first priority. This was considered an important step, because in the process of improving small ruminant's productivity through crossbreeding with exotic breeds that originates from temperate regions has been generally regarded as the solution and taken into consideration to improve the genetic makeup of the local breeds. The long term evaluation program suggests that the Indonesian local breeds are prolific animals and non-seasonal breeders (Setiadi et al., 1984). Although they are relatively smaller in size, the local breeds are now believed to be superior in terms of long term total production per ewe/doe and more efficient in the utilisation of feeds (Sitorus and Soebandriyo, 1982), better adapted to the local environment and presumably meet the market quality standard.

The Balai Penelitian Ternak in collaboration with the SR-CRSP (Small Ruminant - Collaborative Research Support Program funded by USAID) has initiated a major breeding program, still on going, to investigate the possibility of a dominant gene determining prolificacy in the JTT sheep.

The tropical environment in Indonesia is warm and humid, and the native sheep produce very poor quality of wool. With a view of improving this situation, hair sheep (St Croix - Virgin Island White) were imported in late 1985. Their crosses with the local Sumatran sheep appear very promising (Sanchez, 1988). Further tests are required to evaluate the performance of the hairsheep and crosses when introduced to and raised under traditional management practices.

Studies on the genetic potential of breeds of goats in Indonesia have not been as elaborate as those with sheep. Basuki et al. (1981) have reported some measurements of the productivity of Saanen goats and crosses with the local Kacang goat. The Kacang goat appears to be better adapted to traditional management practices in transmigration areas than to the Etawah goat. Except for the Etawah goat, the fact is that at present most of the imported goat breeds are rarely found in great numbers as pure breds.

In view of the smallholder farm system, breed improvement programs are faced with many constraints, but a village genetic improvement/breeding program is currently being developed.

Feeding and Nutrition

The major constraints in feeding and nutrition of small ruminants in the village are shortage of feed and land use devoted for feed production. Feed evaluation studies have been the focus of attention in the past and is still on-going. The results of the nutrition studies with small ruminants over the past have been reviewed (Johnson and Djajanegara, 1989). Almost all available feeds have been analysed and evaluated through supplementation trials, where the feeds were provided at various levels as a supplement to elephant grass (Pennisetum purpureum) as basal roughage. The inclusion of various levels of concentrate feeds e.g. rice bran, corn meal, coconut oil cake have shown improved gains (Mathius et al. 1982). The mineral status in animals in the village has also been studied. Sitorus and Sutardi (1984) have attempted the measurement of the energy and protein requirement of the local goat, and have recently reviewed feeding experiments carried out in Indonesia. Haryanto and Djajanegara (1989) indicated some relationships between energy and/or protein and average daily gains of sheep and/or goats. There is a necessity to establish nutrient requirement standards for sheep and goats for Indonesia, in particular, and the humid tropics in general, since the nutrient requirement standards of NRC do not include requirements for small ruminants of less than 20 kg liveweight. While improvements in average daily gains of growing animals were achieved given additional feed supplements (from 50 to 100 g/d), there is little information on nutrient requirement and responses of pregnant and lactating ewes/does to dietary treatment.

The potential of grazing small ruminants under rubber, in addition to utilising available forage includes the reduction in weed control costs with no adverse effect on the rubber trees. The results of the experiments with sheep grazing under rubber have been reviewed by Sanchez (1988).

The beneficial effects of feed supplementation have not yet been extended to the farmers. The future trend of the small ruminant industry appears more towards medium scale small ruminant fattening farms, hence, the approach in nutrition and feeding research may be directed towards improving feed efficiency of concentrate feeds.

Socio-economic Aspects

The small ruminant industry in Indonesia is dominated by smallholder farms which rely on family labour and low capital inputs. Most of studies on socio-economic aspects have described the conditions of the small ruminant production systems management (Knipscheer et al., 1983; Suradisastra, 1984; Wahyuni and Gatenby, 1985). The results have provided a better understanding of condition and constraints. However, there appears to be no simple solution because of the complexity of, and interaction between, factors that are involved and influencing the production of small ruminants. Socio-economic studies and monitoring activities are still on-going in conjunction with transfer of technology activities in an Outreach Pilot Project (OPP) in West Java and North Sumatra.

Jahi et al. (1989) have revealed in a study of the Cimanuk Valley that contacts with extension personnel are limited. Preliminary

findings in the OPP project in West Java and North Sumatra indicated that small ruminant producers made substantial progress, if they were provided with information/guidance and other support services. This suggests that implementation of extension programs and activities directed towards improving the management of small ruminants needs to be given more emphasis in the future.

Disease Control

Research on small ruminant disease control is carried out at the Balai Penelitian Veterinary (Balitvet : **Research Institute for Animal Disease/RIAD**). The work at Balitvet covers all major aspects of veterinary disease e.g. Virology, Parasitology, Bacteriology, Toxicology etc. In small ruminants, the research focused on the major diseases found in small ruminants. The problem of scabies and orf (Indrawati et al., 1984) has been dealt with and preventive measures are considered more important than treatments. Outbreaks of disease in small ruminants are rare, however, under the present management practices many factors apart from disease could greatly induce disease problems.

INSTITUTIONS AND PERSONNEL INVOLVED

A number of institutions are actively involved in the production of small ruminants. These include research, information, training and extension agencies under the Ministry of Agriculture, universities under the Ministry of Education and Culture, private enterprises, with the Directorate General for Livestock Services having agencies in every province and district. At present it is not clear how many persons are involved in developing activities in small ruminants.

Recently, a meeting of Institutions developing activities in small ruminants have been organised involving 20 institutions which are located in Java and Bali (Djajanegara and Iniquez, 1988). One of the objectives of the meeting was to discuss the proposed establishment of a national network on small ruminants in Indonesia. An inventory of the institutions involved in the network and personnel has been prepared. It is recognised that many institutions, apart from those already involved in the network, are also actively involved in small ruminants i.e. agencies under the DGLS, faculties of animal science of universities located outside Java and a number of private enterprises.

DOCUMENTATION AND INFORMATION EXCHANGE

To date, there is no special publication that only deals with small ruminants. Most of the research results on small ruminants are documented in scientific publications still requiring to be translated into farmers language. The Balai Informasi Pertanian (BIP : Agriculture Information Centre) is a centre under the Agency for Agriculture Education, Training and Extension (AAETE) that is responsible for the collection of information, redistribution and dissemination in general agricultural aspects, including those in small ruminants.

Publications from research institutes are available in limited numbers, hence, exchange is limited. Irregular meetings in the form

of seminars, workshops are occasionally being held. The Directorate of Livestock Services also disseminates through conducting on-farm trials new technologies before they are recommended to the farmers. In this context, a close working relationship between the Directorate and research institutions has been established.

CURRICULA AND TRAINING

Training towards a degree in animal science is carried out at universities. Students at the Faculties of Animal Science are given courses in breeding/reproduction, nutrition, management, socio-economics in general, while veterinary aspects are given at the Faculty of Veterinary Medicine. Aspects of small ruminant production are included in the courses. The period required to obtain a degree varies from four to six years.

Short term training in small ruminant production techniques for extension officers and farmers is provided by the Balai Latihan Pegawai Pertanian (BLPP) and Balai Penyuluhan Pertanian (BPP), both coordinated by AAETE. To promote small ruminant production in Indonesia, graduate training and short term training for extension workers will need to be given priority.

FUTURE RESEARCH

It is important to note that the basis of the small ruminant industry in Indonesia will remain and involve the poor smallholders.

The Directorate of Livestock Services will initiate a package development program to improve the production of small ruminants through improved management (Project **INDOKAM** = Intensifikasi Domba dan Kambing or Intensification of Sheep and Goat Management). Under this program improving the genetics of the indigenous breeds, feed and feeding practices, disease control, management and marketing aspects are treated in one package. The strategy should be technologically adoptable, economically feasible, socially acceptable and environmentally sound in order to produce a large impact. The increasing human population, restricted agricultural and land resources, and possible change of small farm enterprises to medium or large scale agro-business and agro-industries may also greatly influence the future of small ruminant research and development programs in Indonesia.

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PRIORITIES FOR RESEARCH AND DEVELOPMENT ON SMALL RUMINANTS IN MALAYSIA

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ABSTRACT

The sheep and goat population of Malaysia is approximately 100,000 and 270,000 respectively, mostly owned by smallholders. There is now considerable interest in integrating small ruminants, especially sheep, in rubber oil palm and coconut plantations to make use of the vetetation and control weeds. The main focus of research is in forage and agro-industrial by-products utilisation, crossbreeding and new breed formation, reproductive performance and animal health. The institutions involved, sources and exchange of information, training and future research direction are summarised.

INTRODUCTION

Small ruminant production in Malaysia is undertaken mainly by economic units in rural areas comprising smallholders engaged in mixed cultivation, landless estate workers and landless non-estate workers. Under traditional conditions, goat and sheep are reared and allowed to graze in flocks ranging from two to thirty in numbers. These farmers regard the animals as a form of savings rather than as production units. Lack of capital, inefficiency in resource management, low productivity and income per farm and weak bargaining power at the time of selling are some of the most typical disadvantages of these farmers.

Recently, there is an increasing trend of keeping goats and sheep confined in their shed and feed brought to the shed in the form of cut grass and fodder. Most of the progressive farmers, following this trend, regard goat or sheep flock as production units.

Large scale goat and sheep rearing although few in numbers is gaining interest. These farms may raise 100-300 head of goats or sheep or both for commercial purposes. Feed is usually obtained from estate fringes or road shoulders. Improved pasture is seldom used (Hawari, 1988). Yet, another production system which is gaining more popularity is the integration of small ruminants, mainly sheep, with plantation crops such as rubber and oil palm, where ground vegetation forms part of the ecosystem in plantations and serves as a useful source of feed. A large corporate plantation sector, Guthrie, a few statutory bodies such as Federal Land Development Authority (FELDA), Rubber Industry Smallholder Development Authority (RISDA) and Federal Land Consolidation and Rehabilitation Authority (FELCRA) together with the Department of Veterinary Services have implemented and are continuing

to promote the large scale rearing of sheep in integration with plantation crops. A description specifically of sheep production in Malaysia has recently been given (Wahid et al., 1988).

CURRENT GOAT AND SHEEP POPULATIONS AND TRENDS

A 1987 estimate of population size of goats and sheep in Malaysia (Ibrahim - pers. comm.) and trends in subsequent years have been presented in Table 1. Rate of population growth is estimated to be 11% for sheep and just over 1% for goats. In order to meet the local demand of mutton and goat (Table 1), 90 to 92% of the total requirements have to be imported even after the year 2000 unless large scale breeding and production programs are not implemented within the country.

TABLE 1. TRENDS IN POPULATION SIZE, LOCAL MEAT PRODUCTION AND ESTIMATED DEMAND

Year	Population size		Mutton/goat meat production (metric tonne)		Estimated demand (metric tonne)
	Goat	Sheep	Local	Import	
1977	332,000	51,544	804	4230	-
1982	289,457	61,380	578	3523	-
1987	269,113	97,852	486	6099	-
1990	288,000	126,000	711	-	9,227
1995	302,000	203,000	927	-	10,799
2000	318,000	327,000	1254	-	12,589

Source - Ibrahim, pers. comm

High demand and extraction rate in goats have in fact reduced the population size. A reverse trend may be expected in future because of large scale integration programs in rubber, oil palm and coconut plantations and in orchards, some of which may also involve goats, in addition to sheep.

Realising these bleak prospects, the Government of Malaysia has planned to encourage further importation of sheep to increase both numbers and size.

PRODUCTS

Traditionally, the Malaysian farmers have utilised goats and sheep for production of meat and offals, the latter usually being fed to fish and other animals. Only a few farmers obtained milk from lactating female goats (does) for their own consumption and in rare cases for sale. Some medicinal value is attached to goat milk and

therefore is highly priced. There are no organised tanneries dealing with goat or sheep skins but a few small traders, mainly near the cities, process the skin for local utilisation. By-products other than the offals are seldom utilised.

BREEDS

The base population of sheep and goat in Malaysia is made up mainly of the Malaysian indigenous sheep or MALIN and Katjang respectively.

Various types of purebreds and crossbreds imported in Malaysia include :

Sheep : Dorset Horn, Wiltshire Horn, Poll Dorset, Suffolk and Romney; Border Leicester x Merino.

Goat : Anglo Nubian, Jamnapari, Alpine, Saanen and Toggenburg; Australian Feral.

Two new breeds of goats (Jermasia and Jermana) were locally developed through crossbreeding of Katjang foundation females and German Fawn males, and subsequent selection for growth rate (Jermasia) and milk production (Jermana). Jermasia has 50% Katjang genome and 50% German Fawn genome. Jermana has less than 25% Katjang genome and more than 75% German Fawn genome.

RESEARCH PRIORITIES AND DIRECTION FOR EACH SPECIES

Sheep

Since the increasing numbers of sheep are being integrated with plantation crops, most of the research organisations have focused their research emphasis on the effect of supply and quantity of feedingstuffs (plantation undergrowth, agro-industrial by-products, conventional feedstuff) and ecophysiological environments in plantations (light, moisture availability, terrain etc) on the performance of animal (Tajuddin et al., 1988). A substantial amount of research in this regard has already been done by the Rubber Research Institute of Malaysia, Kumpulan Guthrie Berhad, and Malaysian Agricultural Research and Development Institute (MARDI). The following directions of research have emerged :

a) There is an urgent need to identify and rectify problems that affect efficient forage management in plantations. Quantity and quality of supplementary feeding in relation to different stages of production have to be optimised.

b) In view of the low lambing rate of Malin and Malin x exotic crosses, investigations are in progress to find the cost effective method of increasing the lambing rate of about 110% to about 150% per year (Ani, 1988).

c) Evaluation of several Malin x exotic crosses in order to determine the genetic merit of parental exotic breed.

Availability of breeding stock to implement large scale breeding program is also a problem.

From the results, formulate long-term breeding programs with the aim of establishing new breeds adaptable to Malaysian environment.

d) Health problems pertaining to high mortality in sheep have been identified. Prevalent diseases include endo- and ectoparasites, pneumonic pasturellosis, E. coli, Karato conjunctivities (pink eye) and contagious ecthyma. Further investigations on the health and disease problems and formulation of national health and disease prevention programs are in progress.

f) Research for strengthening local marketing.

g) Research on increasing the efficiency of extension programs suitable for plantation smallholders.

Most of the above research priorities involving sheep-plantation integration are also related to the needs of small farmers practising conventional sheep production systems.

Goats

Since the goats are primarily regarded as important contributors of animal protein, meat and milk, to the rural community, most of the research programs by various institutions (MARDI, University of Malaya, Universiti Pertanian Malaysia and Veterinary Department) have been directed to meet the requirement of the smallholders. In general, the research priorities and direction for research are listed below :

a) Devising production systems suitable for smallholders' management of goats, and also in plantations. These to include most cost-effective housing.

b) Research on forage production, use of agri-by-products and formulation of cost effective rations for growing kids, breeding animals and lactating does.

c) Conservation of local genetic resources and development of new breeds of goats through crossbreeding and selection

d) Investigation on the high mortality of goats and devising preventive measures to reduce mortality.

HIGHLIGHTS OF RESULTS

1) Ground vegetation serves as a useful source of feed for sheep and goat in rubber and oil palm plantations, but in order to sustain economic productivity of sheep, some form of supplementation (approximately 20-30% DM requirement) is necessary (Devendra, 1978; Ani et al., 1986; Wan Mohamed, 1987; Rajion et al., 1988).

2) Comparative digestive efficiency of goats have been found to be superior when trials were made with various types of grasses and concentrates (Devendra, 1978).

3) Two new breeds of goats have been created through crossbreeding and named as Jermana and Jermasia.

4) Improved reproductive management (identification of oestrus through hormonal assay, quick detection of post-partum oestrus) has increased further the prolificacy of Katjang goats

5) A marked improvement in birth weights, pre-weaned survival rate and average daily gain has been recorded in sheep with improved lamb and ewe management and crossbreeding in oil palm and rubber plantations (Ani, 1988).

6) Conception rate of breeding does has been increased to 70% through oestrus synchronisation and artificial insemination (Sivaraj, 1988 - pers. comm.).

7) Dorset Horn and Poll Dorset have shown better climatic adaptability than Suffolk, Border Leicester and Corriedale under shade and grazing under trees (Dollah et al., 1988) as revealed by various physiological indicators.

INSTITUTIONS AND NUMBER OF PERSONNEL INVOLVED

Institutions	Number of University graduates involved in small ruminant research
Department of Veterinary Services	6 (excluding the State District Veterinary Officer)
Malaysian Agricultural Research and Development Institute	14
Universiti Pertanian Malaysia	6 (excluding graduate students)
Universiti Malaya	4 (excluding graduate students)
Universiti Kebangsaan Malaysia	2
Rubber Research Institute	2
Guthrie Research, Chemara	4
Ebor Research, Sime Darby Plantations	2
Rubber Industry Smallholder Development Authority (RISDA)	1
Federal Land Development Authority (FELDA)	2
Federal Land Consolidation and Rehabilitation Authority (FELCRA)	1

Institutions	Number of University graduates involved in small ruminant research
Farmers' Organisation Authority	1
Federal Agricultural Marketing Authority	2
TOTAL	47

DOCUMENTATION AND INFORMATION EXCHANGE

Research and development activities are documented in the annual report of each of the institutions listed above. Scientific publications of Malaysian research in small ruminants have been recorded in many international journals (eg. World Animal Production Review, Tropical Agriculture, SABRAO Journal, etc.) and in local journals (Malaysian Applied Biology, Malaysian Veterinary Journal, Malaysian Agriculture Research Journal, Kajian Veterinary, MARDI bulletin). A book written by Drs C. Devendra and M. Burns entitled **"Goat Production in the Tropics"** (Publisher - Commonwealth Agricultural Bureaux, 1983) incorporates many of the publications from Malaysia on goats.

Information exchange between scientists and development workers usually occurs through annual meetings of various societies eg. Malaysian Society of Animal Production, Veterinary Association, which usually include a scientific conference. Proceedings of these conferences are usually available as pre-prints.

The Commonwealth Agriculture Bureaux has its regional office in Kuala Lumpur through which a literature search can be quickly obtained by small ruminant researchers. The National Library of Malaysia and local University libraries can provide limited literature search facilities, most of them have access to information dissemination facilities of C.S.I.R.O., Australia.

Regional information exchange occurs biannually through the meetings of Asian-Australasian Animal Science Association, which now publishes a journal, the base of which is Seoul National University, South Korea.

CURRICULA AND TRAINING

UPM has degree programs in Veterinary Science and animal sciences in which students are taught aspects of management, nutrition, breeding, diseases and marketing of sheep and goats. Both UPM and UM have postgraduate programs to train M.Sc. and Ph.D. students in sheep and goat production.

MARDI runs regular short courses for various levels and areas of training in sheep and goats. UM has run a few courses on goat breeding and reproduction for veterinary officers, veterinary assistants and progressive farmers.

FUTURE RESEARCH DIRECTION

Most of the current research programs mentioned under "Research priorities and direction for each species" are expected to be further consolidated. Long-term breeding programs for genetic improvement of sheep and goats, optimum utilisation of undergrowth and agro-industrial by-products, devising suitable strategies to overcome problems pertaining to growth and reproductive management, research on integrated approach to marketing and continuous research for strict health control of small ruminants will form the basis of future research. Collaboration of various research and development institutes is essential for making the future research a successful endeavour.

Research on embryo transfer and culture with the objective of applying these techniques for open nucleus breeding systems in future is expected to receive priority in future programs of UPM, MARDI and UM.

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PRIORITIES FOR RESEARCH AND DEVELOPMENT ON SMALL RUMINANTS IN NEPAL

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ABSTRACT

The population of sheep and goats in 1987/88 was 873,000 and 5,211,000, respectively and is growing at the rate of 4.3% in sheep and 2.3% in goats annually. The sheep and goats are mainly concentrated in hill and mountain belt of the country. There are four breeds of each species. Government intervention on sheep development started in 1958. At present, there are four sheep and two goat farms run by the government. The major activity of these farms until lately has been production of crossbred animals for distribution to farmers through extension channels. Data are available regarding the performance of native, crossbred and exotic breed of sheep and goat on the government farms. There is a need to extend this and other research work to the "on-farm" situation.

INTRODUCTION

The production of small ruminants in Nepal has recently been described (Pradhan, 1986, 1988). Nepal is bordered by China on the North and India on three sides south, east and west. The average distance from the Mechi River in the east to the Mahakali River in the west is 885 km. The distance north to south varies from 145 km to 241 km. Altitude ranges from 300 m in the Terai plains of the south to more than 8000 m in the Himalayas, with a gradual rising from south to north. The total area of the country is 147,181 sq. km. The ecological region can be divided into four main eco-zones from the livestock raising point of view:

High Hills - above 3,000 meters in altitude
Midhills - Between 1,500 and 3,000 meters
Lower Hills - Between 300 and 1,500 meters
Terai - Below 300 meters

Yaks and chauries, sheep and goats, are raised mainly in the High Hills. Cattle, sheep, and goats predominate in the Midhills while buffalo and pigs appear below 2,000 meters in altitude only. In the Lower Hills and Terai all species are found but with a thinner population of long-tailed sheep especially in Terai. Out of the total land area the Terai region occupies only 17% compared with 68% and 15% for the Hills and High Mountains, respectively. Similarly, pasture land covers 13.4% when compared with 18.0%, 37.6% and 15.3% for agriculture, forest, and snow-covered mountains respectively. The country

experiences a subtropical type of climate in the Terai, a temperate to monsoon climate in the Hills and alpine to temperate climate in the Mountains.

DISTRIBUTION AND GROWTH OF SHEEP AND GOAT POPULATIONS

Nepal's small ruminants population in 1987/88 consisted of approximately 873,000 head of sheep and 5,211,000 heads of goats. Of these, 87.6% of the sheep and 73.2% of the goat are estimated to be found in the Hill and Mountain regions. Sheep are distributed equally in the Hills and Mountain regions, whereas goats are found predominantly in the Hill region (Table 2). The growth rate of the Kingdom's sheep and goat population is estimated at 4.3% and 2.3% respectively (Table 1).

TABLE 1. LIVESTOCK POPULATION 1984/85 - 1986/87 (10^3)

Species	1984/85	1985/86	1986/87	1987/88
Cattle	6357	6372	6363	6343
Buffalo	2839	2891	2918	2952
Sheep	785	808	837	873
Goat	4882	5016	5090	5211
Pig	442	456	476	516
Fowl	8920	9311	9528	9784
Duck	267	277	297	334

Source: A Handbook of Agricultural Statistics of Nepal, DFAMS, 1988

TABLE 2. DISTRIBUTION OF SHEEP AND GOATS IN THREE ECO-ZONES OF NEPAL (10^3)

	Sheep		Goats	
Region	Nos.	%	Nos.	%
Mountain	383	43.9	805	15.5
Hills	382	43.7	3011	57.8
Terai	108	12.4	1391	26.7
Total	873	100.0	5207	100.0

SHEEP AND GOAT PRODUCTS

Sheep and goats provide meat, wool, manure, hide, skin, and transport. Out of the total estimated annual meat production of 137,200 mt in Nepal, 3,000 mt (2.1%) comes from sheep and 28,000 mt (28.0%) from goats. Wool production from different sheep breeds is estimated to be 744 mt per annum. Total pashmina wool from two goat breeds, Chyangra and Sinhal, are estimated at 86 mt per annum (Table 3). Hide and skins from sheep and goats, are estimated to total 163 and 1,232 mt, respectively (Shrestha and Sherchand, 1988).

TABLE 3. MEAT AND WOOL PRODUCTION IN NEPAL
(10^3 mt, 1986/87)

Meat Production :		% of total
Buffalo	91.0	66.3
Sheep	3.0	2.2
Goats	28.0	20.4
Pigs	9.0	6.6
Chicken	6.0	4.4
Duck	0.2	0.1
TOTAL	**137.2**	**100**
Wool production:	744.0	

Source: A Handbook of Agricultural Statistics of Nepal, DFAMS, 1988

SHEEP AND GOAT BREEDS

Four distinct breeds each of sheep and goats have been identified in Nepal. The animals of the each breed differ in terms of body weight from one region to another. They are classified as follows based on the production system.

Sheep	Goats	Area
Bhyanglung	Chyangra	back side of Himalayas
Baruwal	Sinhal	mountains and mid hills
Kage	Khari	lower hills
Lampuchhre	Lamkane	terai

DEVELOPMENT OF HIS MAJESTY'S GOVERNMENT SHEEP AND GOAT FARMS

Sheep and goat development farms have been established by the Government of Nepal to test and produce breeding stock of different exotic breeds in order to upgrade the productivity of native breeds. This activity was launched in 1959 with the arrival of a flock of Rambouillet, Dorset Horn, Corriedale and Romney Marsh from the United States in 1958. At present, there are four sheep development farms (Chitlang, Jumla, Pansaya Khola, and Pokhara) and two goat development farms (Bandipur and Dhangadi). Crossbred males produced at the farms are distributed to local farmers. Recording of productive and reproductive performances on these farms has not been rigorous as production was the primary objective. However, a significant amount of data has been recorded and can provide a basis for evaluating breed performance.

PERFORMANCE CHARACTERISTICS OF NEPALESE SHEEP AND GOATS

Jamnapari kids were found to have higher birth weight and weaning weights compared to Khari and 50% crossbreds (Gunung, 1983).

Age at first kidding in Jamnapari crossbred does increases with increased levels of Jamnapari blood. At Bandipur age at first kidding was estimated at 527 days in pure Khari compared to 592 days in 50% crossbreds and 724 days in Jamnapari.

At the Bandipur Farm, shortest kidding interval, 281 $\pm$ 16 days was found in Khari doe compared to 315 $\pm$ 15 days in 50% crossbred and 372 $\pm$ 3 days in pure Jamnapari (Sainju, 1988). At Dhangadi Farm also, Khari does have shown a similar number of days between kidding at 312 days.

Litter Size

Kharis have shown greater litter size, 1.54 kids per litter, as compared to 50% crossbred, 1.28, and Jamnapari, 1.12 (Sainju, 1988).

The percentage of litters with multiple births was reported as 48% in Khari, 34% in 50% crossbreds and 26% in Jamnaparis (Gurung, 1983).

Kid Mortality

Up to weaning at the age of four months, Jamnapari kids at Bandipur have shown a higher level of mortality (18.3%) compared to Khari (7.3%) and 50% for crossbred kids (Gurung, 1983).

Live Weight Weaned Per Doe Per Annum

In goat meat production systems, the live weight of kids weaned per doe per annum is an important measure of performance that combines the traits of doe fertility, mothering ability, and kid survival. Live weight weaned is a useful measure for selection of does and measurement of breed performance.

Khari goats at Bandipur had lower total kid live weight at

weaning, 13.5 kg, compared to 14.3 in 50% crossbreds and 14.2 in pure Jamnapari (Sainju, 1988).

Productive Performance: Sheep

Crossing with the Merino d' Arles increased slightly. The "Kambouillet" breed has been developed in Nepal an F_2 - 75% Rambouillet and 25% Kage (local). This crossbred shows good adult bodyweight when compared to other exotic crossbreds using the Rambouillet and Kage breeds. Birth weight of single-born lambs of Kage, Rambouillet, and linebred F_2 at Chitlang Sheep Farm were 1.7, 2.8 and 3.5 kg, respectively. Average adult body weight of ewes of the Kage, Rambouillet and Kambouillet were 22, 36 and 36 kg respectively. Polwarth and French Merino D' Arles breeds were introduced on stations in the High Hills. These are for crossbreeding with native sheep breed Baruwal. The Baruwal produced 0.85 kg of greasy wool per annum as compared to Polwarth and Merino D' Arles 2.61 kg and 2.2 kg respectively.

RESEARCH PRIORITIES IN SHEEP AND GOAT

Need For An "On-farm" Research Approach

Sheep and goat are found in all types of farming systems. Sheep and goat rearing is both practicable and profitable for farmer, resulting in significant production of meat and wool and significant financial returns.

To improve production, practical research is needed. Most livestock research in Nepal has been conducted "on station" with very few practical results reaching the farmer's flocks and herds. To produce new, appropriate livestock technologies, research projects must be carried out "on-farm", in the farmer's herds and flocks and with the farmer's full participation. On-farm trials can result in social acceptance of new technologies and their rapid transfer to the farmers.

Study of the Breeding Performance of Khari Goats

The native Hill goat, Khari, represents 35.3% of the total goat population of Nepal (Shrestha and Sherchand, 1988). It is a prolific and economic breed for small farms achieving three kiddings in two years with proper management. As meat production is the most important trait for Hill goats emphasis at the goat research and production farms should be put on the selection of goats based on kg of kid weaned per kg of doe body weight. Keeping this in view, recently research on goat production systems which include Khari goats have been launched under support from the International Development Research Centre (IDRC) of Canada.

Improvement of the Performance of Baruwal Sheep and Chyangra goats

Sheep and goat in migratory flocks represent a major source of income for herders in the High Mountains and Hills of Nepal. Out of the total population of sheep and goat, 70% are Baruwal sheep and 6.2% Chyangra goat (Shrestha and Sherchand, 1988). Research should be done on the selection of breeds appropriate to the conditions of the

Mountains and on management practices to improve sheep and goat productivity.

Special emphasis should be put on improvements of the Chyangra Goats. The Chyangra is a preferred source of meat, especially during the Desain festivals when thousands of Chyangras are ritually slaughtered. Further, the Chyangra produces an average of 150 to 175 grams of fine Pashmina wool per head per year. Pashmina produced in Nepal is considered to be of the best quality bringing very high prices in the world market.

Improvements of the Kage Sheep Breed

The Kage breed of sheep is known to be prolific and hardy. It is raised in small sedentary flocks in the Midhills. The demand for mutton in Nepal is increasing and opportunities exist to develop more productive sheep systems in the Midhills. Research is needed to improve the Kage without reducing its prolificacy or losing adaptive traits.

Nutrition Research

The following are the suggested lines of research in the field of ruminant nutrition :

a) Nutritional characterisation of native grasses, legumes and fodder tree leaves.

b) Testing of production performance of sheep and goats based on intake and digestibility of locally available feeds and fodders.

c) Development of low cost concentrate sources.

Additional Research Focuses

The following subjects are identified as "on-farm" and "on-station" sheep and goat research in Nepal:

a) Breeding of improved Khari and crossbred goats for small farms in the Midhills focussing on crosses of the Khari with Jamnapari and Barbari breeds.

b) Monitoring of costs and returns from goat enterprises "on-farm" in the Midhills.

c) Study of different control measures for coccidiosis and other internal parasites in pre-weaning goat kids

d) Measurement of productivity and economics of stall-fed goats in the Midhills

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RESEARCH AND DEVELOPMENT ON SMALL RUMINANTS IN PAKISTAN

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ABSTRACT

Pakistan has 27 million sheep and 31 million goats, and the numbers are increasing. Productivity is low due to deterioration of the feed resource base. The country has an impressive array of indigenous breeds - 28 for sheep and 25 for goats. In many of the sheep breeds, wool is a very important commodity. First priority is to improve nutrition of the sheep and goats by pasture improvement and increased fodder production and utilisation. Other important research and development areas are breeding and crossbreeding to improve quality and productivity, animal health disease prevention and internal parasite control, improvement of infrastructures for trained personnel, marketing and industry organisation.

INTRODUCTION

Amongst Pakistan's endowment are several high quality breeds of sheep and goats. These small ruminants play an important role in the lives of tens of thousands of small farming families, most of whom are either landless or migratory/transhumant in the province of Baluchistan. They move their flocks for foraging wherever they find some vegetation, and thus cover long distances in search of feed and water. Stall feeding is practically unknown, except perhaps, with some livestock owners in the irrigated plains. The result is that animals are generally lean and in many situations half-starved. The ranges are over-grazed, and the animals are slaughtered in conditions that are close to emaciation. If, however, these animals are fed and fattened properly before slaughter, the genetic potential of breeds is such that the country can almost double its mutton production and there can be considerable improvement in the quality of various products/by-products obtained from these small ruminants. A certain amount of adaptive research on some selected research stations has been underway for the past two decades, but a greater thrust is required on prioritisation of research on these animals - be it in the field of breeding or nutrition or disease control or even the marketing of various products.

CURRENT POPULATIONS

According to preliminary data released by Pakistan's Agricultural Census Organisation for the livestock census carried out in 1986, the following is the tabulated population figure for the total country, as well as its scatter in various provinces :

TABLE 1 : SHEEP AND GOAT POPULATION

	(Million Heads) Sheep	Goats
Pakistan	23.28	29.95
N.W.F.P.	2.24	4.20
Punjab	6.69	10.76
Sind	2.62	6.76
Baluchistan	11.11	7.30
Northern Areas	0.64	0.94

From this table, it would be clear that the major provinces where the bulk of sheep and goat are raised are the provinces of Balushitan and the Punjab. The provinces of Sind and N.W.F.P. have also sizeable populations of goat.

Besides this population, small ruminants are also being maintained in and around the camps of Afghan refugees.

TABLE 2. LIVESTOCK WITH AFGHAN REFUGEES

	(Million Heads) Sheep	Goats
Afghan Refugee Camps		
N.W.F.P.	1.49	0.48
Baluchistan	2.50	0.79

Source : Afghan Refugee Operations Directorate Report 1987

TRENDS IN POPULATION GROWTH

There has been a steady increase in the inventory of Pakistan's small ruminants. The goat population has kept pace with the growth of human population (around 3% per annum), but the sheep population has grown at a rate of about 2% per annum. The data on population dynamics are complicated by the fact that there is considerable "disappearance" of livestock, including small ruminants at the borders with neighbouring countries.

Sheep and goats are generally reared under mixed farming system. Besides household raising and sedentary stock, the norm in Baluchistan and parts of N.W.F.P. and Sind is through nomadic/transhumant system.

TABLE 3. TRENDS OF POPULATION GROWTH

Year	(Million Heads) Sheep	Goats
1973	14.83	16.93
1976	19.53	22.47
1982	22.12	25.84
1986	23.28	29.95

Source : Livestock Division.
Ministry of Food and Agriculture,
Government of Pakistan

PRODUCTS

Meat

The main purpose for which sheep and goat raised is to get mutton. Goat mutton is the preferred meat in large parts of the country, except in Baluchistan and N.W.F.P. where sheep mutton is the meat of choice. Another important feature is that consumers prefer to buy lean goat meat i.e. meat almost free from fat. Accordingly in the Punjab and Sind, breeds of sheep and goat with less body fat are being promoted for selection. This is not true in Baluchistan and N.W.F.P. where fat-tailed sheep are bred to meet the consumer preference. In parts of Sind, very young lambs are slaughtered because people like what could be called "lamb-veal". In some larger cities like Rawalpindi-Islamabad, Lahore, Faisalabad, Multan etc smaller-sized carcasses weighing about 7 to 8 kg from young goat are preferred, and this trend is increasing. The concept of a "broiler goat" or a "broiler lamb" may be pursued in future to cater for such a taste. This is probably dictated by large mushrooming of a type of dish served in way-side restaurants that is called "Karahi" meat - tender mutton, cooked on open fire that is ready to be served in about 30 minutes. "Teddy" goats come in handy for this purpose in parts of Punjab.

The production of mutton has progressed as follows :

TABLE 4. MUTTON PRODUCTION TREND

	(Thousand Tonnes) 1973	1976	1982	1986
Mutton, sheep and goat	245	303	370	500

The per capitum consumption of mutton (both urban and rural) is assessed at 3.3 kg per year. This contribution comes significantly from goats. As stated elsewhere, mutton production in Pakistan can almost be double if suitable measures are taken for improved feeding and disease prevention.

Milk

Although sheep and goat are raised principally for mutton production, their milk is of considerable importance to owners of migratory flocks where large ruminants, particularly milk producing animals are not available. Some breeds of goat have excellent milk-producing capability (Beetal, Kamori, Dara Din Panah) and are popularly known as poor-man's-cow, but because of shortages of feed, they also produce much below their genetic potential. Tabulated below is the data on milk production.

TABLE 5. MILK PRODUCTION FROM SHEEP AND GOAT

	(Thousand Tonnes)			
	1973	1976	1982	1986
Sheep	22	28	32	42
Goat	228	303	348	464

Wool and Hair

The share of foreign exchange earnings from the overall livestock sector comes to around 12% - the most important exports being leather and leather products, followed by export of hand-knotted carpets (Rs. 3 billion). Raw wool export (9 million kg) is offset by importation of fine quality wool. Tabulated below is the data for production of wool and hair and export of hides, skins, wool and wool-related products from Pakistan.

TABLE 6. WOOL AND HAIR PRODUCTION

	1978-79	1979-80	1980-81	1981-82	1982-83	1983-84	1984-85	1985-86
Wool	35.4	37.1	38.9	40.7	42.7	45.1	47.7	50.3
Hair	4.8	5.0	5.3	5.5	5.8	6.1	6.6	7.0

TABLE 7. EXPORTS OF PRODUCTS FROM SMALL RUMINANTS

	Exports	Imports	Surplus
Skin and hides and related products			
Raw skin	1,420	-	1,420
Leather products	1,072	-	1,072
Footwear	105	-	105
Sub-total	2,597	-	2,597
Wool and related products			
Raw wool	274	240	34
Woolen garments	50	-	50
Rugs and carpets	2,683	-	2,683
Sub-total	3,007	240	2,767
TOTAL	5,604	240	5,364

BREEDS OF SHEEP AND GOAT

Sheep

In Pakistan, there are 14 fat-tailed and an equal number of thin-tailed, well defined and recognisable breeds of sheep. (Akhtar and Haider 1974; Hasnain 1985). These are listed below :

Province	Fat tail	Thin tail
Baluchistan	Harnai, Baluchi, Bibrik, Rakhshani	-
N.W.F.P.	Hashtnagri, Balkhi, Michni, Tirahi (Afridi)	Damani, Kaghani
Punjab	Salt Range (Latti)	Buchi, Cholistani, Kajli, Lohi, Sipli, Thalli
Sind	Dumbi	Kachhi, Kooka
Northern Area	Gojal, Kohai Ghizer	Baltistani
Azad Kashmir	Pahari	Kail, Kali, Poonchi

Besides these breeds, exotic breeds were also introduced and crossbreeding was done with local sheep. Following exotic breeds were imported :

SHEEP - Rambouillet
- Karakul
- Awassi

GOATS - Angora

For crossbreeding, local Kaghani, Lohi and Kacchi sheep have been used. Significant improvement in birth weight, weaning weight, daily growth rate, pre-weaning survival rate and wool production was achieved.

Goats

There are 25 well-recognised breeds of goat in Pakistan. Besides these, many other strains have been recorded. Listed below are the main breeds of goat in Pakistan.

Baluchistan	Kajli, Khurasani, Lehri
N.W.F.P.	Damani, Gaddi, Kaghani
Punjab	Beetal, Nachi, Dera Din Panah, Teddy
Sind	Barbari, Chappar, Kamori, Desi
Northern Area	Baltistani, Jararkheil, Kohai Ghizer, Piamiri
Azad Kashmir	Beiari, Buchi, Desi, Kooti, Labri, Pothohari, Shurri

RESEARCH PRIORITIES AND DIRECTION

Looking at the sheep and goat inventory and its trend, it is not difficult to comprehend that in Pakistan, there has been a steady deterioration of resource base for livestock (including small ruminants) production. Listed below are some of the significant factors :

1) Seriously disturbed land : livestock ratio because of large inventory on reduced areas.

2) Over-grazing and reduced carrying capacity causing severe nutritional stress.

3) Reduction in fodder area by about 1.0 million acres without concomitant increase in per acre yield of forage crops.

4) lack of suitable institutional structure, paucity of funds, inadequate research support and insufficient professionally trained manpower.

The above summarises the national scenario. At the farmers level, the problems are further complicated by the following factors :

1) Serious feed shortages.

2) High mortality from diseases and parasites.

3) Absence of producers' organisation.

4) Unorganised marketing.

5) Artificially depressed product prices.

6) Lack of policy support.

Realising the importance of livestock sector in general, the 7th Five Year Plan (1988-93) has set certain targets for production, and outlined certain measures for the realisation of these goals. The direction is towards :

1) Encouragement of private entrepreneurs to establish feedlot units.

2) Utilisation of agro-industrial by-products and animal wastes for feeding of livestock including small ruminants.

3) Leasing of marginal state land on long lease for sheep and goat farming.

4) Improved animal health.

5) Improved marketing and credit facilities.

6) Better organised research and development on various livestock species including sheep and goat.

In order to boost livestock production in the country, and with a view to meeting rising demand on livestock products, the following strategy has been adopted in respect of research priority planning up to year 2000.

1) Research on high yielding varieties of fodders, and large-scale use of processed feed based on by-products.

2) Breed improvement through selection and crossbreeding.

3) Development and maintenance of herd immunity through preventive vaccination against major epidemic diseases.

4) Dipping, drenching and de-worming of small ruminants against important parasites both internal and external.

5) Adoption of scientific land-use cropping patterns and farming systems through research on farmers stock.

6) High quality research on animal production, health, marketing and use of computers.

7) Large-scale exploitation of rangelands.

8) Establishment of by-product processing units.

HIGHLIGHTS OF RESULTS

Reproduction

Research on small ruminants in the past has been fragmentary and non-sustained. Some work has been done on reproductive traits, cross-breeding, fattening and control of diseases. A few institutes are now developing long-term and systematic research programs that will pay increased attention to twinning percentages, feedlot systems, cross-breeding, blocks for stall-feeding and rapid diagnosis of diseases.

Tabulated below is some data on fertility twinning rate, growth rate in some selected breeds such as Lohi, Awassi, Kacchi and crossbreds. There was some improvement in crosses with Awassi :

TABLE 8. PRODUCTIVE AND REPRODUCTIVE PERFORMANCE OF SHEEP

Breed	Birth weight (Kg)		Weaning weight (Kg)		Preweaning daily gain (Kg)		Adult weight (Kg)		Fertility (%)	Twining (%)
	M	F	M	F	M	F	M	F		
Awassi	4.3	4.1	28.0	26.0	0.20	0.18	73.6	73.7	79	16
Lohi	3.8	3.6	27.8	26.2	0.19	0.17	75.0	48.0	79	32
Awassi x Lahi	4.2	3.9	28.6	26.6	0.21	0.18	71.0	43.0	68	11
Kachhi	3.2	3.1	24.0	19.0	0.17	0.13	55.7	35.9	91	6
Awassi x Kachhi	4.1	3.9	30.0	26.0	0.21	0.18	63.2	42.1	91	5

Source : Annual Reports, Livestock Production Research Institute, Bahadurnagar (Okara)

Saleem and Shah (1983) made a study on twice a year lambing system of Lohi sheep in order to have more meat from sheep. The authors concluded that early weaning and removal of suckling stimulus helps early resumption of cyclic activity of sheep. It was reported that under twice a year lambing system, 12.66 kg more live weight could be produced per ewe per year and that each ewe gave net extra income of Rs. 104.31 per year in the form of meat, skin and wool from lambs, as compared to once a year lambing system.

Crossbreeding in sheep yielded significant results. Some of salients points are summarised as under :

(Rambouillet x Kaghani)

1) The F_1 crossbreds were 35 to 73% heavier than the native Kaghani breed in birth weight and 18 to 33% in weaning weight.

TABLE 9. STUDY ON TWICE A YEAR LAMBING

Frequency of lambing	Average number of lambs produced/ewe	Average birth weight (kg)	Average weaning at 30 (kg)	Average final weight at 120 days age (kg)	Average weight at 120 days/ ewe(kg)
Twice a year	1.89	3.67	8.99	20.88	39.46
Once a year	1.06	3.38	9.22	25.22	26.80

2) Preweaning daily growth rate of F_2 and F_3 lambs were about 20% better than Kaghani lambs.

3) Wool production : crossbred adult females produced up to 50% more wool than native Kaghani breeds, with lower fibre diameter, staple length and less kemp.

Nutrition

Many research experiments on sheep and goat nutrition have been successfully completed. The use of urea-molasses blocks has become popular amongst the farmers, as a result of gains demonstrated by experiments conducted on owners' stock. Mizra et al. (1988) have demonstrated substantial economies from the use of these blocks in controlled experiments.

Health

Ovine and caprine pleurophnemonia has taken heavy toll of sheep and goat in certain mountainous parts of the country. Special research projects were sanctioned and effective vaccine is being prepared to control killer diseases.

INSTITUTIONS AND PERSONNEL INVOLVED

Federal	Institute	Number of scientists involved
	National Agricultural Research Centre (Animal Sciences Institute) Islamabad	4

Provincial

Punjab

Livestock Production Research Institute, Bahadurnagar	2
Livestock Experiment Station, Kheriwala	1

INSTITUTIONS AND PERSONNEL INVOLVED

Federal Institute	Number of scientists involved
Livestock Experiment Station, Kheri Murat	1
N.W.F.P. Livestock Experiment Station, Jaba	1
Baluchistan Usta Mohammad Farm, Loralai, Maslakh	2
Sind Nabisar	2
TM Khan	2

DOCUMENTATION AND INFORMATION EXCHANGE

Published literature on sheep and goat is scattered in journals and proceedings of various Conferences/Symposia etc. Listed below are a few of these documents :

Title	Authors
Livestock Wealth Haider	Dr A S Akhtar and Mr S M Naqi
Documentation of Goat Breeds in Sind	Dr G B Isani (Final Report)
Sheep and Goats in Pakistan	Dr H U Hasnain, FAO Animal Production and Health Paper 56, Rome
Final Reports on Investigation and Research on Pakistani Wool and Hair	Mr S M H Abidi
Proceedings of International Seminar on Sheep and Wool	PARC - Islamabad (1982)
Goat Production in Pakistan	M Ishaq Shah 1986
Livestock Resources of Pakistan	Abdul Wahid (University of Karachi

Title	Authors
Sheep Production in Pakistan	Editors : J B McIntash (In press) A S Akhtar

CURRICULA AND TRAINING

Following institutions impart training for DVM/B.Sc AH/M.Sc/Ph.D students :

a) College of Veterinary Sciences, Lahore

b) Faculty of Veterinary Sciences, Faisalabad

c) Faculty of Animal Husbandry, Faisalabad

d) Faculty of Animal Husbandry and Veterinary Sciences, Tandojam

e) Faculty of Animal Sciences, Peshawar

In Animal Husbandry Faculties, separate curricula for under-graduate and post-graduate level have been developed for sheep and goats. Master's degree and Doctorate degree are also offered based upon research titles pertaining to sheep and goats.

The curricula for specific subjects pertaining to sheep and goats being taught in various institutes in the country.

Training

All faculties, departments, institutes and livestock experiment station in the country arrange short term training on different aspects pertaining to sheep and goats. Occasionally some international donor agencies also offer budgets for such training. In this connection, Pakistan Agricultural Research Council has played a leading role in providing funds and other infrastructure for short term trainings. Consultants from abroad are also invited as trainees.

FUTURE RESEARCH DIRECTION

Keeping in view the rising demands for livestock products including mutton, the following strategies have been developed :

Animals

a) Organisational and institutional structure.

b) Manpower training.

c) Breeding, nutrition, diseases and marketing.

d) Producer's co-operatives.

Food Crops

a) Introduction of high yielding varieties.

b) Agronomy.

c) Resource improvement and conservation.

d) Seed farms for fodder crops.

The following research thrusts have been worked out :

1) Improvement of feed resources and establishment of demonstration centres.

2) Production of exotic germplasm for crossbreeding.

3) Development of high quality sheep and goat breeds.

4) Improved productivity of sheep and goats through Nationally Coordinated Research Projects under different farming systems.

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PRIORITIES FOR RESEARCH AND DEVELOPMENT ON SMALL RUMINANTS IN THE PHILIPPINES

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Philippines

ABSTRACT

Sheep and goats are generally raised by smallholders and form an integral part of smallholder agriculture. In general, the flock/herd is composed of indigenous stocks although farmers are keen to upgrade the quality of their animals whenever improved stocks are available. The present population is two million goats and 7000 sheep. Research and development on small ruminants are focused on the development of strategies to increase the breeding base and animal holding of farmers, improve the quality and performance of the native stocks and the effective delivery of support services (i.e. market, credit, extension services, etc) to ensure economic viability of small ruminant projects. A small ruminant research and development network already exists comprising two national centres, four regional centres and 12 cooperating stations involving 48 scientists.

INTRODUCTION

The Philippines can be credited for near-sufficiency in pork and poultry products. However, it produces barely one percent of its milk and 40% of its beef requirement. With the country's human population growing geometrically, the supply of meat, milk and other farm products is becoming insufficient.

To provide a solution to this concern, the livestock sector is looking for strategies to increase livestock production and development schemes suited to smallholder farmers. In view of this, strategies to promote maximum utilisation of small ruminants are being developed, the merits of which include (1) augmenting the dwindling supply of farm products particularly meat and milk, (2) providing employment to idle family members, (3) providing additional income to smallholders from sale of stocks and by-products, and (4) optimum utilisation of farm resources such as farm by-products.

A detailed account of sheep production and development in the Philippines has been published (Faylon, 1988) while another on integration of goats with coconuts is also available (Parawan and Ovalo, 1986).

CURRENT GOAT AND SHEEP POPULATIONS AND TRENDS

Goat farming forms an important and integral part of smallholder agriculture in the Philippines.

Data show that of all the livestock species, the goat population exhibited a relatively favourable annual growth rate of about 2.54% from 1980 to 1988 (Table 1) to a present population of 2.12 million of which 99% are on small farms.

TABLE 1. GOAT POPULATION (10^6, 1980-88)

1980	1.67
1981	1.70
1982	1.78
1983	1.86
1984	2.36
1985	2.19
1986	2.18
1987	2.02
1988	2.12
Average Annual Growth Rate	2.5%

Sources : Bureau of Agricultural Statistics (BAS) Bulletin (1988) and Villar and Faylon (1986)

On the other hand, population of sheep in the country remains very small. A recent study conducted by PCARRD revealed that there are only about 7,164 sheep. Of this number, about 86% are of the indigenous stock. Introduction of new breeds has been very limited. Some degree of inbreeding is probable among the available stocks.

Generally, sheep are raised in small farms and given minimal attention. Just like goats, they are tethered or let loose to feed on any available grasses and weeds.

PRODUCTS

Goat products and by-products are many and varied. These include milk, chevon and fleece. Milk obtained from goats is used essentially for the same purpose as cow's milk such as fresh milk, cheese and butter. Goat meat on the other hand, is popularly prepared as "caldereta", kilawin, pinapaitan, barbecue and stew and has a higher demand than sheep meat.

When compared to other red meat production, chevon production was relatively low. From 1986 to 1987, production increased by only 3.7% from 38,580 MT to 40,000 MT but this was compensated for by higher

price. For both chevon and mutton, per capita consumption was estimated to be 1.56 kg.

BREEDS

Goats and sheep are believed to have been introduced in the Philippines during the early colonial periods. Since then, these species have thrived but have undergone genetic deterioration due to inbreeding, although the process has evolved breeds more resistant and adaptable.

From 1947 to 1964, a total of 671 exotic breeder goats including Anglo Nubian, Saanen, Alpine, Toggenburg, La Mancha and Jamnapari were imported from the USA, Australia and India for the purpose of upgrading the local stocks (Villar and Faylon 1986). Later, in the seventies when rural based programs of the government gave emphasis on goat production particularly towards upgrading the local stocks, the government-owned farms and breeding centres and some private farms imported additional purebreds to increase the breeding stocks.

However, out of the array of exotic breeds introduced and infused to the natives stocks, the upgrades of the native x Anglo-Nubian have seemingly adapted under the Philippine conditions. Specifically, the 50% native and 50% Anglo-Nubian have been proven to thrive not only under improved system of management in commercial farms, breeder centres or research stations but also under smallholder farms where animals are dependent on whatever feed resources are available.

Similarly, the local flock of sheep is a result of natural selection that has been going on for many decades, even centuries, dating as far back to the Spanish era (Baconawa 1988). During the last 50 years, breeds such as the Shropshire, Barbados Blackbelly, Border Leicester, Poll Dorset have been introduced but there are no records of performance of these breeds.

RESEARCH PRIORITIES AND DIRECTIONS

Research priorities for goats and sheep vary significantly considering the volume of R & D data generated for each species.

Between 1974 and 1986, the technology profile on goats is relatively significant. On a selective basis, a total of about 156 studies covering varied disciplines have been done on goats for the last twelve years (Faylon *et al.*, 1986). For sheep, a meagre total of 33 documented research studies were implemented for the last 50 years (Table 2).

Considering the extensive research and development efforts done on goats, the small ruminant commodity team of the National Livestock Research and Development Network formed and developed by PCARRD identified the following in order of priority :

1) Technology transfer system for goats.

2) Effective and economical prevention and control of major diseases and parasites of goats.

TABLE 6. INVENTORY OF RESEARCH AND DEVELOPMENT ACTIVITIES

Discipline	Goat (1974-1086)	Sheep (1936-1987)
Physiology	8	5
Breeding and reproduction	30	3
Feeds and feeding system	39	12
Management system	24	4
Product evaluation, processing and utilisation	14	4
Animal health	26	2
Socio-economics	1	3
Milk and dairy processing	14	-

Source : Faylon et al. 1988

3) Nutrition and feeding systems for improved goat production.

4) Goat production and management system studies under different agro-ecological zones and socio-economic situation.

5) Breeding and reproduction studies for improved goat production.

6) Processing and utilisation of product and by-products from goats.

HIGHLIGHTS OF RESULTS

Most of the research previously conducted on goats are unfortunately still unpublished and in fact needing technical validation or verification before they can really be classified as technologies and information suitable for dissemination. Summaries of research and development activities are available and will therefore serve as a base for developing future strategy.

INSTITUTIONS AND PERSONNEL INVOLVED

The establishment of the Philippine Council for Agricultural Research (PCAR) in 1972, now the Philippine Council for Agriculture, Forestry and Natural Resources Research and Development (PCARRD) brought about the coordination of research and development (R & D) activities among various independent agencies. The creation of the National Research and Development Network (NRDN) strengthened the

national effort to make R & D in agriculture and natural resources responsive to the needs of the end users and to develop and verify appropriate technologies suited to specific needs and problem areas. The NRDN covers various agencies involved in R & D. These agencies are working on crops, livestock, forestry, fishery, farm resources and systems, and socio-economics research and development. Plans and measures are currently being initiated to formalise the formation of a distinct Small Ruminant Commodity (goats and sheep) and fuse the dairy and beef into one commodity known as cattle commodity. Revised R & D priorities for small ruminants distinct for goat and sheep have already been drafted by the national small ruminant commodity team.

The small ruminant R & D network is currently composed of two national centres at Los Banos and Central Luzon State University, 4 regional centres and 12 cooperating stations distributed throughout the country. The national R & D centres conduct basic and applied researches on small ruminants.

The regional R & D centres conduct applied studies of major importance in the regions where the centres are located. These centres verify R & D results from the national R & D centres which show potential for application in specific regions.

The cooperating stations in the network provide facilities and/or sites where adaptive trials or field experiments are undertaken considering the micro environmental differences. In some cases, stations with adequate resources and developed capability may be involved in verification activities.

There are 48 scientists from various agencies who are implementing the 1989 Small Ruminant National R & D program. At the same time, these researchers may be implementing one or more studies in other livestock commodities. As of 1989, there are about 59 ongoing R & D studies on small ruminants.

DOCUMENTATION AND INFORMATION EXCHANGE

As a technical arm of PCARRD, the Livestock Research Division (LRD) systematically monitors, evaluates and coordinates ongoing and new R & D projects in the livestock sector being implemented by various government agencies and, to a certain extent, those of the private institutions.

Terminal reports of completed R & D projects or published technical articles are retrieved, inputted, and stored in a computer system for use by the researchers, students, academicians, and even livestock raisers.

In cooperation with the Applied Communication Division, LRD has published a series of popular articles lines on small ruminants.

All these printed materials are circulated not only in the National Research and Development Network but are also sold to the general public.

The outreach program of PCARRD as a whole, includes servicing the information needs of the national research network through the

Scientific Literature Service (SLS).

Other information systems which store information on small ruminants are the Asian Information Bank of SEARCA at the Regional (ASEAN) level and the Agricultural Research Information Service (AGRIS) of UPLB.

CURRICULA AND TRAINING

There is no formal course on small ruminant production in state colleges and universities. The inclusion of these species in the agricultural education system is merely as a component of the Animal Science curriculum. However, the focus is more on the biological performance of sheep and goats or the capability of the animals with references to breeds and breeding, physiology, nutrition, reproduction, animal, health, etc.

As an area for specialisation, undergraduate, graduate and postgraduate students study the basic or applied aspects of raising either sheep and goats.

Periodically, the Department of Agriculture through the Bureau of Animal Industry conducts farmer seminars and/or technician training on goat or sheep raising.

As private agency, the Technology Livelihood Resource Centre includes in their training programs or course in goat raising. Trainings in this agency cater to prospective raisers or businessmen who are interested in venturing into the business.

When the National R & D team for small ruminant commodity was convened at PCARRD early this year, the need for manpower development in the field of small ruminant production was established. During the consultation, the team identified the training needs of the different regions in terms of discipline and program type.

FUTURE RESEARCH DIRECTION

Although ongoing and completed researches cover all the disciplines of animal science, these studies were designed to establish the basic data for the potential value of native goats. Studies to develop strategies to improve production efficiency of goats and sheep as source of meat and milk needs to be undertaken and since most of the goats and sheep are in the hands of smallholder farmers, it would be beneficial to identify developmental projects appropriate to the resources of the smallholder farmers.

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PRIORITIES FOR RESEARCH AND DEVELOPMENT OF SMALL RUMINANTS IN SRI LANKA

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ABSTRACT

The population of goats and sheep in Sri Lanka is 534,000 and 29,000 respectively. More than 70% of the goats and 90% of the sheep are distributed in the dry and intermediate zones of the country. Goats and sheep are reared almost entirely for meat. The majority are unimproved local or indigenous types. Breeds of goats such as Jamnapari, Saanen and Anglo-Nubian have been imported to the country in the past. The indigenous sheep breeds called Jaffna local remained rather unchanged in the Northern Peninsula. Improved sheep breeds such as Polled Dorset and South Down from England and Bunnur, Red Madras and Bikaneri from India were also imported in the past but their impact on the improvement of the sheep industry has been small. The research priorities in the past were focused mainly on the herd improvement of indigenous types of small ruminants. There are about 37 potential research and extension personnel available in the country who are directly or indirectly involved in research and development of small ruminants.

INTRODUCTION

Until few years ago, the major thrust towards livestock development in Sri Lanka was centred around the dairy, poultry and pig industries. In early 1981, interest in the development of the small ruminants was evoked with the offer of assistance from the Federal German Republic. A goat development project was initiated under this program in 1982, with the objective of upgrading the local (indigenous) goats by crossbreeding with the German Boer breeds. A paper on the integration of crops and small ruminants by Rajaguru (1986) covers many aspects of sheep and goat population.

CURRENT GOAT AND SHEEP POPULATION TRENDS

The population of goats in Sri Lanka is around 534,000 while the sheep population is relatively small being about 29,000. The population trends over the last three decades are given in Table 1. The distribution of goats and sheep in different agro-climatic zones is shown in Table 2. It is evident that during the last two decades, the number of goats and sheep and the extraction rate remained relatively unchanged.

TABLE 1. POPULATION TRENDS OF GOATS AND SHEEP FOR THE PAST THREE DECADES (10^3)

Year	Goats	Sheep	Extraction rate (%)
1960	491	52	22.8
1965	600	35	22.0
1970	558	27	23.3
1975	547	28	25.5
1980	493	28	27.3
1985	539	27	25.4

Source : Ministry of Rural Industrial Development (1985)

TABLE 2. DISTRIBUTION OF GOATS AND SHEEP IN DIFFERENT AGRO-CLIMATIC ZONES (1986, %)

Agro-Climatic Zone	Goats	Sheep
Wet Zone	17.8	1.0
Wet Intermediate Zone	7.7	3.1
Dry Intermediate Zone	19.5	23.7
Dry Zone	54.8	72.2

Source : Ministry of Rural Industrial Development

The greater proportion of both goats and sheep are found in the dry and dry intermediate zones.

PRODUCTS

In a recent survey, it was revealed that the percentage of goats reared for meat, milk and both meat and milk were 89.14, 2.75 and 8.39 respectively, indicating that goats are reared mainly for meat. The fact that there are no milk breeds of sheep in the country suggests that all the sheep are reared for meat. Mutton production based, on the number slaughtered in the registered slaughter house, is about 12,000 tonnes in 1986. Importation of mutton into the country had been rather small in quantity and irregular. Per capita consumption of mutton has declined from 0.47g/day in 1960 to 0.25g/day in 1985. This decline in the per capita consumption is a result of the increase in the human population and not due to a decline in production, which has

remained rather more or less static in the past (Table 1).

Comparatively small number of goats reared for milk production are located in the urban areas and in the plantation agricultural areas. The milk goats reared in these areas are mainly crosses of indigenous goats with Saanen and Jamnapari. There is no organised program in the country for the utilisation of by-products of the small ruminant industry. The skins are processed and marketed in the urban areas by the private sector. The limited amount of low quality wool produced by the sheep are used for the manufacture of rugs and toys by a few government and private institutions.

BREEDS

The majority of the goats and sheep reared in the country are indigenous types. According to Rajaguru and Senanayake (1987), 53% of goats are of the local type, 3% of Jamnapari, Saanen, Kottukachchiya and Boer breeds and 24% of crosses of these over local and 17% are non-descriptive. Periodically, improved goats and sheep have been imported in the past to upgrade these indigenous small ruminants. The breeds of goats imported to the country to upgrade indigenous goats were Jamnapari from India, Saanen and Anglo-Nubian from Europe. Recently, the German Boer breed was introduced from West Germany. The improved breeds of sheep imported to the country in the past were Bikaneri, Bannur and Red Madras from India and Polled Dorset and South Down from England. The most popular cross produced out of the breeds of goats originally introduced to the country is Jamnapari x indigenous. But since there was no planned program to continue the upgrading program of the indigenous goats, appreciable results could not be achieved. However, the herd upgrading program introduced recently by the use of German Boer, under the Sri Lanka German Goat Development Project, has already yielded promising results.

Of the small number of sheep found in the country, the majority are found in the Norther Peninsula. They are mostly of indigenous origin called Jaffna local. There had been very little herd improvement activity in this region in the past. The imported European breeds are located in the mid and hill regions of the country due to the suitability of the climatic conditions for these breeds. The Indian breeds have been introduced mainly to the coconut growing areas of the intermediate zone.

Several state farms now maintain small herds of pure and crossbred goats and sheep for herd improvement programs. The details of the breeds and crosses reared in these farms are given in Table 3.

RESEARCH PRIORITIES AND DIRECTIONS FOR EACH SPECIES

Goats

In the past, the research priorities in goats have been mainly confined to genetic improvement of indigenous goats by upgrading them with improved breeds imported to the country detailed under the item Products.

TABLE 3. DETAILS OF SMALL RUMINANTS REARED IN GOVERNMENT FARMS

Location	Goat breeds and crosses	Herd size	Sheep breeds and crosses	Herd size
Horakelle	J x L	84	R.M x B	-
Oyamaduwa	J x L	429	R.M. x B	-
New Zealand Farm (Ambawela)	Pure Saanen	183	-	-
Marandawila	-	-	B, B- x R.M.	-
Boralanda	-	-	D, D x S.W.	218
Kottukachchiya	Pure German	55	Crossbreeds	642
	Boer			
	75% B x 25% L	103		
	50% B x 50% L	1476		
Thelehara	Kottukachchiya	223		
	Grade Jamnapari	115		
	J x K	99		
Weerawila	Crosses of J & K	651	Bi crosses	
Peradeniya Univ	Boer and J x L Jamnapari, Saanen S x L, B x (J x L)	150	Bannur, Dorset D x B Bi x L, B x (Bi x L)	142

Breeds of Small Ruminants :

Goats : J (Jamnapari), S (Saanen), K (Kottukachchiya), L (Local or indigenous) and B (German Boer)

Sheep : B (Bannur), Bi (Bikaneri), D (Dorset), S.W. (South Down) and R.M. (Red Madras)

Limited number of specific research projects have been conducted by the researchers of the Department of Animal Production and Health in some areas of production characteristics and reproductive performances of indigenous non-descriptive breeds and the imported Jamnapari breeds.

However, the information available on the productive and reproductive traits of indigenous goats and their crosses is insufficient to implement a meaningful herd improvement program by cross breeding with improved breeds. Also, insufficient follow-up activities of the improved crosses produced in the past have led to the degeneration of production traits. Fortunately, the reorganised herd

improvement program initiated under the Sri Lanka German Goat Development Project in 1983 to use German Boer to upgrade indigenous goats and their crosses has already yielded promising results.

It should also be mentioned here that the goat research unit of the Department of Animal Science of the University of Peradeniya has yielded limited information on the productive and reproductive performance of the crosses of indigenous goats with pure Jamnapari and Saanen breeds. Also, a collaborative research program was conducted with the researchers of the University of Tokyo to evaluate the blood morphology of the indigenous goats, with the intention of studying the genetic variation of the indigenous goat types distributed in the country.

Further, the University of Peradeniya, Department of Animal Science is involved in a nutritional evaluation of the tree fodders and shrubs commonly fed to the small ruminants. Plans are also already underway to conduct a detailed study of productive, reproductive and nutritional parameters of the indigenous goats in the above institution in collaboration with the Veterinary Research Institute of the Department of Animal Production and Health with the assistance from the World Bank.

The research on the health aspects of small ruminants in the past has been rather confined but research has been conducted in such areas as worm burden patterns, coccidiosis, respiratory infections, pneumonia (Bathirathan et al., 1986; Horadagoda et al., 1981).

Sheep

Since the population of sheep in Sri Lanka is extremely small (Table 1), the limited research programs have been mainly confined to the evaluation of the performance of imported improved breeds and their crosses (Buranendran 1978; Goonawardena et al. 1981).

HIGHLIGHTS OF RESULTS

Some of the important findings of the research programs of the Kottukachchiya Government Goat Breeding Station are :

Growth responses of 100% and 75% German Boer goats were superior to the 50% Boer, Jamnapari and Kottukachchiya breeds, but all were superior to the indigenous goat.

The University of Peradeniya goat research program has revealed that the average age of conception and age at first kidding of the triple cross (Jamnapari x Saanen x Local) was lower than the crosses of Jamnapari and Saanen x Local and that Jamnapari x Local crosses had a longer kidding interval than Saanen x Local crosses.

Unfortunately, there is no report on the production characteristics or reproduction potential of the indigenous Jaffna local sheep. Of the breeds imported to Sri Lanka, the Polled Dorset has proved to be well adopted to mid and hill country, and Bannur and Red Madras have performed better than rest of the Indian breeds evaluated for the dry and intermediate zones.

INSTITUTIONS AND PERSONNEL

37 professional staff are employed in sheep and goat research equally divided between the Department of Animal Production and Health and the facilities of the University of Peradeniya.

DOCUMENTS AND INFORMATION EXCHANGE

Research findings are published in following Sri Lankan journals : Sri Lanka Journal of Agricultural Sciences, Journal of National Science Council of Sri Lanka, Sri Lankan Veterinary Journal.

CURRICULUM AND TRAINING

The Government Department of Animal Production and Health runs courses as follows :

1) A 2-year Diploma course in Animal Production.

2) A 1-week course in Goat and Sheep Production.

3) A 3-day farmer training course on Goat management.

The Department of Animal Science, Faculty of Agriculture, University of Peradeniya has both undergraduate and postgraduate courses which include sheep and goat production.

Research projects on different aspects of small ruminant production are assigned to Undergraduate and Postgraduate specialisation students in the past three years with the development of facilities for small ruminant research in the Department of Animal Science.

FUTURE RESEARCH DIRECTIONS

Goats

The important areas of research recommended to be undertaken are :

a) Characterisation and evaluation of indigenous goat types in Sri Lanka and phenotype/locality differences. Genetic improvement of existing breeds and crossbreds.

b) Improvement of the nutritional status of goats through study of current farmers feeding practices, evaluation of commonly need feeds, feed requirements and ultimately optimum feeding systems.

c) Improvement of reproductive standards of goats in Sri Lanka, through studies of the important reproductive parameters, their variation due to breed and cross, nutritional and seasonal influences.

d) Carcass and meat quality evaluation of indigenous goats and their crosses.

e) Economics of goat production and marketing. Study of present management and marketing systems practised by farmers to identify the factors limiting economic returns and formulate improved marketing strategies.

f) Utilisation of by-products of the small ruminants.

g) Research priorities in diseases of small ruminants should be directed towards the evaluation of economic measures of prevention or elimination of the more important disease problems present in the country.

Sheep

Since the population of sheep in Sri Lanka is extremely small, the relevant research proposals outlined for goat could be adopted to improve the sheep industry of Sri Lanka. Due to the low prolicacy of sheep when compared to goats reared in the country, improvement of the sheep industry could be recommended to the coconut triangle in the intermediate zone of Sri Lanka, where a low cost sheep operations are possible by the utilisation of the pasture and fodder under coconut.

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PRIORITIES FOR RESEARCH AND DEVELOPMENT ON SMALL RUMINANTS IN THAILAND

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ABSTRACT

This paper presents an overview of small ruminant production and current research and development in Thailand. Some results of the research on goats are reviewed. Recommendations for future research and development on small ruminants are proposed.

INTRODUCTION

Most of the goats and sheep of Thailand are found in the southern region where the Thai Muslim population is relatively high. They are traditionally integrated with agricultural systems by small farmers. In the past decades, little research has been conducted on the potential for increasing production in this environment. Although some development programs aiming to improve their productivity by means of introducing exotic breeds were intermittently carried out (Chantalakhana 1985; Sarobol 1985), no conclusion can be drawn regarding the performance and the suitability of the crossbred animals under village production systems. Recently, there is more emphasis on the importance of small ruminants to villagers in the southern region. In 1984, Department of Animal Science at Prince of Songkla University (PSU), in collaboration with the Thai-Australian PSU Project, commenced a long term research and development program to improve village production in southern Thailand (Jinahyon 1985). The Department of Livestock Development (DLD) has also proposed a long term development program to improve goat and sheep production in this region (DLD 1988).

This paper presents an overview of small ruminant production and development in Thailand, and proposes possible priorities for future research and development on these species with special attention to the southern regions. The earlier paper (Cheva-Isarakul, 1986) describes the integration of small ruminants into mixed deciduous forest in northern Thailand.

GOAT AND SHEEP POPULATIONS AND TRENDS

Among ruminants, buffaloes and cattle are numerically the most significant in Thailand (Table 1). This is largely due to the high

TABLE 1. RUMINANT POPULATIONS AND TRENDS IN THAILAND, (X 10^3, 1978-1987)

Year	Goat	Sheep	Cattle	Buffalo
1978	57	20	4437	5959
1979	63	19	4276	6028
1980	67	32	3938	5651
1981	56	22	4469	6124
1982	38	21	4579	6417
1983	49	27	4833	6354
1984	59	33	4789	6301
1985	74	45	4829	6250
1986	81	58	4879	6257
1987	80	73	4969	5998

Sources: FAO (1980, 1982, 1984, 1986, 1988)

demand for draught power and low-price beef. Nevertheless, goats and sheep are considered as important species to small farmers in the South, particularly in the Thai-Muslim communities where their populations are not greatly different from large ruminants. According to statistics of FAO (1988), goats and sheep in Thailand in 1987 were 80,000 and 73,000, respectively. Although these values contradict the reported values from other sources (eg. Saithanoo et al., 1985a), they suggest that the annual growth rate of goat and sheep populations between 1977 to 1988 are about 3.8 and 15.5%, respectively. Importation of goat and sheep meat to supply local demand in this period was about 27 tonnes per year with and increase of 12% annually (FAO 1980, 1988). About 2,000 goats/month were reportedly imported from Burma during the dry season. It is also evident that goat meat was 90, 26, 30 and 43% more expensive than that of buffaloes, cattle, swine and chicken, respectively. This indicates that the in-country production is not sufficient.

THE PRESENT LEVEL OF PRODUCTION

Approximately 71 and 27% of Thailand's goat and sheep populations, respectively, are in the South, and it is estimated that the total goat population in this region could be as high as 222,000. They are most concentrated in the Thai-Malaysian border zone.

Goat and sheep production in Thailand is primarily for meat. These animals are raised mainly by small farmers as a secondary enterprise in their farming systems. There is no large-scale commercial goat or sheep farming in Thailand. The breeds of goats and sheep in different locations and their main characteristics are shown in Table 2. The main breeds are of the indigenous strains. Milk and wool are secondary products of goats and sheep, respectively, and mainly for home consumption. Because of the small scale of production, other products such as skin, hair and by-products are not economically important. Dairy goats, mainly crossbred goats are estimated to be less than 1% of the total population.

TABLE 2. GOAT AND SHEEP BREEDS IN THAILAND

Species	Breed	Location	Function priority
Goats	Indigenous	All regions	Meat
	Burmese-Bangladesh	North, center	Meat
	Exotic[1] and crossed[2]	Central plain	Milk, meat
	Crosses[2]	All regions	Meat, milk
Sheep	Indigenous	All regions	Meat
	Burmese-Bangladesh	North, center	Meat
	Crosses[3]	All regions	Meat, wool

[1] Refer to Alpine, Anglo-Nubian, Saanen and Toggenburg

[2] Refer to crossed breeds between indigenous/Burmese-Bangladesh and exotic breeds

[3] Refer to crossed breeds between indigenous/Burmese-Bangladesh and exotic breeds (ie. Dorset Horn, Merino, Polwarth)

The indigenous goats are phenotypically similar to the Katjang breed of Malaysia but slightly smaller in size. The indigenous sheep in the South have conformation similar to the Kalatan sheep of west Malaysia, whereas the main breeds of sheep in the North are native and Bangladesh-Burmese strains. Exotic breeds of goats (eg. Alpine, Anglo-Nubian (AN), Saanen, Toggenburg) and sheep (eg. Dorset Horn, German Merino, Polwarth) have been intermittently imported for crossbreeding with the indigenous to improve milk and wool production in goats and sheep, respectively. However, there appears to be some problems regarding the health and performance of crossbred animals raised under village conditions where inputs and level of management are limited (Chantalakhana, 1985).

Some results of the studies on indigenous and crossbred (indigenous X AN, F_1) goats carried out in the PSU Goat Research and Development Program are presented in Table 3. This demonstrates the potential of indigenous and their crosses raised under village and improved management (assumed to be optimum) conditions. Indigenous goats raised under an improved management farm are 25 to 53% heavier than those in the villages. On the other hand, the crossbred are much heavier (16 to 34%) than the indigenous raised under the same condition despite the low milk supply from the indigenous does. Unfortunately, the information on the performance of the crossbred goats raised under village conditions is not available at this stage.

When compared with goats, sheep have received less attention than goats by the Thai government agencies or scientists. As a result, research information on sheep production systems in Thailand is very scarce. Mature body weights of local rams and ewes in the north Thailand highland are 30.1 and 26.2 kg, respectively (Hoane, 1976), whereas average body weights at one and two years of age of the crossbred (indigenous X Dorset Horn) ewe at the DLD Livestock Breeding Unit (Narathiwat) in the South are 30.3 and 36.4 kg, respectively. It is important at this stage that a clear policy and objectives on sheep

TABLE 3. PERFORMANCE OF FEMALE INDIGENOUS AND CROSSBRED (INDIGENOUS X ANGLO-NUBIAN) GOATS RAISED UNDER VILLAGE AND IMPROVED FARM CONDITIONS

Trait	Village	Improved farm	
	Indigenous	Indigenous	Crossbred
Production			
Birth weight (kg)	*	1.73	2.00
Weight at 3 months old (kg)	6.80	9.16	11.15
" at 12 months old (kg)	13.04	20.00	26.73
" at 24+ months old (kg)	21.51	29.49	38.02
Reproduction			
Kidding rate (%)	189.63	160.59	170.83
Pre-weaning kid mortality (%)	29.10	4.95	6.32
Annual mortality of adult (%)	7.20	4.72	1.72

production and development need to be set regarding the areas, breeds and purposes; for example, wool sheep for dry areas and meat sheep for wet areas.

CURRENT RESEARCH AND DEVELOPMENT PROGRAMS

Four institutions are involved in small ruminant research and development in Thailand : (1) The Department of Animal Science, in collaboration with the Thai-Australian PSU Project (funded by Australian International Development Assistance Bureau (AIDAB); 1982-1991), (2) the DLD, the Ministry of Agriculture and Cooperatives, (3) Kasetsart University, Bangkokok, and (4) University of Chiang Mai in Chiangmai. The objectives, personnel, funding and facilities involved in programs of the first two institutions are described below.

The PSU Goat Research and Development Program

The major aim of the PSU goat program is to evaluate and upgrade the local genotype for the improvement of village goat meat production in southern Thailand. The strategic objectives of the program are:

a) To establish a "Centre for Excellence" in goat research and production for the 'humid tropics', the centre to provide training for Thai personnel in aspects of fundamental and applied research, and goat management.

b) To train both academic and graduate staff of the PSU in the application of goat production technology.

c) To obtain baseline data on the present systems of village goat production and marketing.

d) To produce and evaluate crossbred goats for improved production in the various agricultural systems of southern Thailand.

e) To develop and extend improved goat husbandry and management practices.

The program has been designated as the master research project of the Department of Animal Science. The Department staff involved in the program include 8 graduates and 4 graduate assistants.

At the PSU Campus Farm, 120 breeding does, 35 bucks (for breeding program and village work) and about 200 kids (male and female kids to 8 and 12 months of age, respectively) are run on 5.8 ha semi-intensive pasture based system. Features of the goat research facility at the Campus Farm were described in details by Milton et al. (1987).

The indigenous and crossbred goats of different genotypes (viz. 25% AN, 50% AN F_1, 50% AN F_2 and 75% AN) are being evaluated/compared under both improved management and village production systems in order to obtain the biological potential of such genotypes and identify the major factors which limit their productivity. This information will be used in conjunction with information from village surveys on major components of management which contribute to varying level of productivity in villages. Finally, the program will develop "production models/packages" appropriate for particular village systems.

The DLD Small Ruminant Development Program

The major aim of the DLD small ruminant development program is to produce crossbred goats (for meat and milk) and sheep (for meat and wool) and distribute them to farmers in villages (DLD 1988). The objectives of the program are:

a) To support and accelerate goat and sheep development programs in southern Thailand.

b) To improve performance of the local goats and sheep through crossbreeding programs and disseminate crossbred animals to farmers in villages.

c) To extend knowledge, information and advice on management practices to farmers.

Five Livestock Breeding Stations/Units in the South involved in the crossbreeding and extension program have been established.

A mobile extension unit has been set up to provide information and advice on goat and sheep production for farmers in the villages. It will also collect data from the villages and Breeding Stations/Units involved in the programme for further analyses.

The program has received the major funds from the annual budget of the Thai government. In 1988, Winrock International has partly assisted the program by providing stock and technical assistance.

Kasetsart University has a sizeable flock of indigenous goats in which within breed selection is underway. The University of Chiang Mai has a small goat flock and enables studies on meat and milk production potential.

RESEARCH PRIORITIES FOR SMALL RUMINANT DEVELOPMENT

As compared to other countries in the region, small ruminant research and development in Thailand is just beginning. Baseline quantitative information on the farmers as well as productivity of their animals in village situations is very limited. In the past, research programs have failed because the problems considered by research workers were not relevant to the problems perceived by farmers, particularly where only the biological restraints to production were considered. It is, therefore, imperative that information is first acquired on the present biological and sociological determinants of small ruminant production in the villages, and that this information be used to formulate research programs which will have maximum impact at the village level for improving production.

The main research areas for small ruminants in Thailand have been identified as baseline data, nutrition and management, reproductive management and breeding, and animal health. An area being considered as an important part of the PSU goat program is carcass studies. Results of the preliminary study on skin samples of indigenous goats at the PSU Campus Farm indicate that there is a high possibility of introducing a gene for cashmere into the indigenous goats (B.J. Restall, pers. comm.). This may be a new area of future research on goats in this region.

Since most small ruminants are in the villages, systems research approach on integration of small ruminants into the cropping systems (eg. rice, rubber, oil palm and fruit tree plantations) should receive considerable attention.

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GOAT PRODUCTION IN VIETNAM

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ABSTRACT

The population and distribution of goats in Vietnam is given, together with the breeds involved and the production. The goat industry is at an elementary stage of development.

INTRODUCTION

Vietnam is mainly a rice producing country in South East Asia where buffaloes/cattle and pigs are major domestic animals although from time immemorial, goats were also considered one of the five main domestic animals, the four others were buffaloes, cattle, pigs and poultry.

Literature records from the Tenth century affirmed that in Central Vietnam, the goat herd at some family farms has reached 10-20 heads in number. At that time, goats were considered valuable gift to tribal chief families in mountainous regions in the North as well as in the South. Even from that time, goats provided meat for people, especially in mountainous areas, hides for making warm coats and horns for ornamental furniture. The number of goat horns demonstrated the richness of the tribal chiefs. The goats were used also as a draught force in the king's family. The popular rumour is that before going to battle, the tribal soldiers usually drank alcohol with goat blood, since they believed in the force and the victory provided by goat blood. Sometimes, they washed their face and their hands with water containing goat blood. Goat horns and goat bones have been excavated in archaeological sites in North as well as in South Vietnam.

The reasons for the ownership of goats have been mentioned in a few popular tales from Cham ethnic group in Central Vietnam meanwhile the buffalo and the buffalo motif were more popular in folk tales from many main ethnic groups.

In short, if the buffaloes are considered a member of Vietnamese farmer families, the goats themselves are a lost symbol of force. Till now, the goats are in fact, incorporated in material life of the people.

GOAT POPULATIONS

Some recent statistical data in following tables show clearly the place of goats in the national economy.

TABLE 1. THE RELATIVE IMPORTANCE OF GOATS AND OTHER MAIN FARM ANIMALS (10^6, 1987)

Species	South Vietnam	All Vietnam
Pigs	4.4	12
Cattle	1.7	2.9
Buffaloes	0.7	3.4
Goats	0.1	0.3

TABLE 2. THE GOAT POPULATIONS IN SOUTH VIETNAM (1985-87)

Region	1985	1986	1987
Mekong Delta	45,056	44,472	48,221
Central Highlands	48,157	44,410	41,122
Eastern Part of South Vietnam	14,592	17,961	18,639
Total	107,805	106,843	107,982

The new economic policies in animal husbandry are encouraging mainly the cattle and pig populations, while the buffalo and goat population remain fairly constant indicating a lower priority.

The distribution of the goat population distribution is closely related to the goat consumer's tradition, or more particularly, to the ecological characteristics. In general, the goats are raised in poor vegetation, bare soils and relatively dry regions. Only in these difficult conditions, can goats show their superiority to other animals. Goat husbandry in South Vietnam is concentrated in four provinces as shown in Table 2 : Tien Giang province in the Mekong Delta with some 30,275 heads, Gia Lai - Kontum province in Central Highlands with more than 29,616 heads, Thuan Hai provinces in Central Vietnam with about 20,415 heads and Dong Nai province in Eastern part of South Vietnam with 7,676 heads. The total population in these four provinces is 87,982 goats, it means nearly 70% of total population; the remaining 14 provinces keeping only 30% of total population.

The goats are kept mainly in family farms with 5 to 7 heads; in forestry mountainous areas or hilly regions, the family herd can reach 10 to 20 heads. State farms do not practise goat husbandry. In the family herds, the buck doe ratio varies from 1:25 to 1:10. Normally, does occupy 55 to 60% of total population, the young goat and kids 35 to 43% and the bucks 4 to 5%. In these conditions, the artificial insemination is not yet practised.

FEEDS

In general, goats in mountainous areas are bigger, heavier and stronger than those in delta regions. Three main goat breeds commonly raised in South Vietnam are : Grass Breed (Common Breed), Bac Thao Breed and Crossbreds.

1) Grass Breed is the locally adapted and widely spread goat in various ecological areas. These goats are well adapted to poor nutrition and lack of management. It is well-known for high prolificacy. The strongest point of the breed is the small sized, adult does weighing around 26-30 kg, wither height 60 cm. The morphological traits are : short and small horn, small ears, white or black coat, sometimes yellow or ashed grey colour.

2) Bac Thao Breed probably is the cross progeny of imported Beetal and Jamnapari breeds from the 1930s and 1940s and is one of the most common dairy goat breeds. These goats normally are heavier than local ones, the 4 year-old buck weight can reach 35-43 kg and wither height 70 cm. The most distinguished characteristic is two white lines along the head, besides long and large ears. The common coat colour is black with white spots in the belly area.

3) Crossbred goats are the result of natural crossing between these two above-mentioned breeds. The body weight and the wither height are intermediate between two parent breeds. It is in many ecological areas and gives relatively good results.

The following data in Table 3 illustrate the growth rate of three main goat breeds in South Vietnam.

TABLE 3. THE GROWTH RATE OF GOAT BREEDS (kg)

Breed	Birth weight	1 mth	6 mths	1 yr	2 yr	4 yr
Grass Breed						
Male	2.25	4.40	13.10	21.3	29.6	30.3
Female	1.97	4.00	11.80	18.2	24.4	26.3
Bac Thao Breed						
Male	3.10	5.90	17.50	29.4	40.2	43.4
Female	2.66	5.50	16.30	28.1	32.0	35.0
Crossbreds						
Male	2.96	5.40	16.40	29.1	36.2	38.6
Female	2.15	5.30	15.80	27.0	30.0	32.9

PRODUCTION

Reproduction

Puberty begins at the age of 9 to 10 months and oestrus cycle normally lasts 21 days (from 11 to 23 days). In the first kidding, 55% give two kids, 24% - 1 kid and 21% - 3 kids. In the following

kiddings, litter size varies from 2 to 4 kids. The kidding interval also varies from 8 to 11 months.

Normally, the kidding season coincides with spring. The kids normally stay with their mothers till the advanced age with the milk ceases.

Milk Production

All raised goat breeds are poor milk producers. Some records are given below :

Milk Production with stage of Lactation (litres/day)

Sate of lactation	Bac Thao Breed	Crossbreds
1st month	1.58	1.00
2nd month	1.47	1.09
3rd month	1.29	0.82
4th month	0.87	0.73
5th month	0.68	0.62
6th month	0.43	0.40

Milk Production in Various Lactations (litres)

Lactation	Bac Thao Breed	Crossbreds
1st lactation	135.6	116.4
2nd lactation	166.2	142.5
3rd lactation	217.8	148.2
4th lactation	226.8	163.5
5th lactation	231.6	153.9
6th lactation	210.0	132.6

Milk Production

Local goats are also poor meat producers. Normally goats are sent to slaughter at live weights of 30 to 42 kg (at the age of 24 to 48 months). The carcass percentage varies from 44 to 47%. The meat percentage reaches 60 to 63% of carcass weight.

Ho Chi Minh City is the main goat meat market, yearly about 10,000 to 12,000 goats are slaughtered to provide 150 to 180 metric tonnes of meat. This amount meets only 20% of the city's requirement.

Feeding Problem

In some intensive goat farms, the feedstuffs used for dairy goats consist of natural grasses (in the rice field borders and in river dykes), elephant grass, Sesbania leaves plus concentrates - maize powder, rice bran, groundnut cake, soybean cake (or tofu residue). Net energy is high with 2,800 to 3,500 Kcal/Kg and the digestible nitrogen between 97 to 120 g. Such rations are adequate for the maintenance requirement of the doe and production of 1.5-2.0 litre/day of milk.

Common Diseases

Mouth Inflammation is the most common disease of goats (35% of registered cases), followed by diarrhoea (30%), scab (27%), mastitis (60%).

Traditional medicines are still used for controlling common diseases in the goat husbandry.

RESEARCH PRIORITIES

The following research activities are needed to improve goat production :

1) Introduction of high yielding breeds for improving milk and meat production.

2) Improvement of feeding practices aimed at reaching high production and high economic efficiency.

3) Goat product processing, in particular milk treatment and milk marketing.

4) Updating the human resource through knowledge and skill, by procession of overseas degree and non-degree training, and by attending international and regional workshops or seminars.

Goat husbandry was a traditional occupation of vietnamese farmers in some specific areas. Despite the present lack of development, the potentials of natural and human resources in developing goat husbandry in Vietnam are large. Action is needed to develop these resources, perhaps with international cooperation, to achieve the improvement in the goat production.

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SESSION II

STATEMENTS BY INTERNATIONAL
DONOR AGENCIES

SUPPORT FOR RESEARCH AND DEVELOPMENT ON SMALL RUMINANTS BY ACIAR

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ABSTRACT

The Australian Centre for International Agricultural Research (ACIAR) views small ruminants as an important area for research collaboration. Australia has a large sheep and goat population and scientific expertise in small ruminant production unmatched anywhere else in the world. This places it in a unique position to help in collaborative research projects. Currently, it has four projects that focus on small ruminants. A group of three projects looking at increasing the quality and quantity of fine wool production in Chinese sheep and a fourth looking at the epidemiology and control of gastrointestinal nematodes in sheep and goats in the South Pacific Nations. The importance of goats for meat consumption in the South Pacific is well recognised and the need to increase clean wool production has been given top priority by the Chinese livestock authorities. ACIAR has contributed $2.6 million to its small ruminant program over 3 years and AIDAB has assisted the efforts in China with a contribution of $1.3 million. Expansion of the program is envisaged. A brief summary of the projects AIDAB has with a small ruminant component is given.

INTRODUCTION

The goal of ACIAR is to build the capacity of developing countries through collaborative research in the agricultural sciences to improve the social physical and economic well-being of the poor by increasing productivity, stability and sustainability in the agricultural sector.

CURRENT PROGRAMS

ACIAR has 4 projects that focus on small ruminants. First, there is a group of three projects in China :

1) Sheep breeding for improved wool quality in North-west China.

2) The effects of helminths and nutrition on sheep production in Northern China.

3) Mineral nutrition studies of small ruminants in North Eastern and North Western China.

Secondly, a project in the South Pacific which is looking at the epidemiology and control of gastrointestinal nematodes in sheep and goats.

A brief resume of each of these projects is as follows :

Sheep Breeding for Improved Wool Quality in North-West China

Australian research has established the heritability of important wool measurements such as fleece weight and fibre diameter in Merino sheep, and this project will seek corresponding information for the Gansu wool breed.

A flock-testing laboratory will be set up at Lanzhou, as a first step. This will provide the routine measurements of the current wool characteristics in samples from local Gansu fine wool sheep - necessary for the allocation of priorities in selecting replacement animals for the breeding flock. Although clean wool yield and average fibre diameter are the most important ones, the characteristics will also include staple length and strength, fatty matter, ash content, resistance to compression, dark fibre contamination, and fibre diameter variability.

The Effects of Helminths and Nutrition on Sheep Production in Northern China

Helminth infections and poor nutrition are well known to reduce the production of wool and meat in grazing sheep. Surveys conducted in the northern provinces of China show that the common gastrointestinal helminths of sheep such as Haemonchus, Ostertagoa and Trichostrongylus spp. are abundant and widely distributed and outbreaks of disease indicate that parasitism is severe in winter and spring when the availability of forage is limited and the nutritional status of sheep is low. Data describing the nutritional value of herbage grazed in different seasons and of the supplements fed in winter will be valuable for this region of the world.

This project aims to determine the significance of helminths in the family Trichostrongylidae infections and poor nutrition as causes of reduced wool production, both in quantity and quality, and to assess changes in sheep management designed to increase production from Merino sheep in northern China. The nutritive value of pastures and supplements are to be determined for the purpose of assessing the productivity of the present sheep production system.

Mineral Nutrition Studies of Small Ruminants in North-Western and North-Eastern China

This project seeks to establish seasonal growth cycles of the grazing sheep, relate those cycles to the animals' mineral nutritional status, and the response to provision of such deficient elements, in terms of both wool and meat production.

Trials at three representative locations will establish the growth and production patterns of the sheep grazing there. Pasture, blood and tissue samples, collected concurrently with the growth measurements,

will be analysed at the Beijing Institute of Animal Science for a range of elements. Where possible, these will include sodium, potassium, calcium, phosphorus, magnesium, copper, zinc, manganese, selenium, molybdenum, iron, sulphur, nitrogen and cobalt. Apart from revealing any marked deficiencies, such data will define the present physiological levels of the elements in these animals and allow the team to design appropriate animal-house experiments for closer examination of possible interactions.

The Epidemiology and Control of Gastrointestinal Nemotodes of Small Ruminants in the South Pacific

This project is the first of three of four linked projects on goat research in the Tropics. It stems from an initiative of the Ministry of Primary Industry, Fiji, to ACIAR and reflects a concern with the high losses of goats due to parasites in FAO goat development projects. Parasite infestation was also identified as a major constraint to goat production by the staff of the AIDAB Yalavou Project.

Meat consumption in Pacific Island countries far exceeds local production, and these countries are striving to expand their sheep and goat flocks. A meeting of Directors of Agriculture for Pacific Island Nations resolved that small ruminant production would take the highest priority in the development of livestock industries in the Pacific in the foreseeable future.

Gastrointestinal parasites, especially Haemonchus contortus are a serious impediment to expansion of small ruminant flocks. It has been estimated that 25% of the Fiji goat head dies annually from this parasite. Outbreaks of haemonchosis kill up to 50% of goats in some goat farming projects. In Vanuatu, 50% of lambs born are lost to gastrointestinal parasitism before they are weaned. Control of these parasites relies on anthelmintic treatment every three weeks. However, the high cost of anthelmintics, their uncertain availability and the appearance of drug resistance further limit small ruminant production.

Knowledge of parasite epidemiology, including the role played by host genetic resistance, can be used to devise integrated management systems that will reduce the reliance on anthelmintics alone as a control strategy. This strategy could include selective breeding for, or importation of, parasite resistant genotypes.

ROLE OF SMALL RUMINANTS IN SOUTH PACIFIC AND CHINA

At a meeting of Directors of Agriculture for Pacific Island nations held in Apia, Western Samoa in 1983, it was resolved that small ruminant production would take the highest priority in the development of livestock industries in the Pacific. Meat consumption in Pacific Island countries far exceeds local production and these countries are striving to expand their flocks of sheep and goats to help meet this short fall. Fiji, for example, imported 3580.3 tonnes of boneless sheep meat during 1987 worth about $8 million, showing the large scope for increased local production and for import substitution to save foreign exchange.

The situation in China is somewhat different to that in the South Pacific. In China, the emphasis is on sheep rather than goats. China has approximately 129 million sheep of which 30 million are merino. The location of the majority of sheep in China is in the North West and North East regions, with few sheep in the agricultural regions of semi-tropical and tropical China. China has increased its wool production by 46% over 15 years, yet is still well below the production levels of Australia and New Zealand. The low yield of clean wool is a significant area for improvement and the focus of considerable attention at the moment by the Chinese livestock authorities.

FUNDING

Over the last three years, ACIAR has supported the small ruminant projects to the sum of $2.6 million. The Australian International Development Assistance Bureau (AIDAB) has made $1.3 million available as extra funds to support the projects in China.

ACIAR intends to continue to support the existing projects and to expand its small ruminant program into other countries because of the perceived and real importance of these animals to the small farmer.

ROLE OF AIDAB

The majority of AIDAB livestock projects are smallholder based and cover a wide range of activities including the development of state demonstration farms, pasture species evaluation, introduction of new livestock species and cross breeding with the distribution of stock.

AIDAB projects with a significant small ruminant component include The Prince of Songkla University project in Thailand, Mutton Sheep Industry Project in Fiji, Sheep and Wool Industry project in Pakistan, Livestock Development project in Solomon Islands, Sheep Industry and Breeding project in Bhutan; Indo-Australia Sheep Breeding project in India, Sheep Farm project in Korea and Yunman Livestock Development project in China. Totally, these projects represent an investment in small ruminants by Australia of approximately $30 million over recent years.

Small ruminant projects are an important component of Australia's aid program. Small ruminant projects have made significant contributions to other sectors, notably infrastructure and general agricultural development. Experience confirms the appropriateness of continued commitment to small ruminants.

AUSTRALIAN EXPERTISE

Australia has enormous expertise in the small ruminant area with a local population of approximately 160 million small ruminants.

Australian livestock personnel are also regarded highly for their adaptability and their independence in technical knowledge.

Australia is claimed to have a competitive advantage in the Pacific and South-East Asian region because of geographical proximity and experience in countries of the region. However, the paradox is that it also has comparative advantage in dryland agricultural systems and South-East Asia could hardly be described as dry.

Despite this paradox, Australia continues to support small ruminant programs in South-East Asia.

THE FUTURE

Because of their large populations, small ruminants make a significant contribution to the economy and food supply of many countries. Their greatest value in farming systems is associated with small size, low individual costs, rapid turnover, and the conversion of feed resources not directly eaten by man. As the human population increases, the importance of small ruminants will also increase. The need to harness this unique resource has been recognised for some time by FAO, IDRC, Winrock International and ACIAR. We must however, continue to seek solutions to the problems of increasing the production of small ruminants and encourage continued research support.

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INTERNATIONAL DEVELOPMENT RESEARCH CENTRE ACTIVITIES IN RESEARCH AND DEVELOPMENT OF SMALL RUMINANTS

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INTERNATIONAL DEVELOPMENT RESEARCH CENTRE

The International Development Research Centre (IDRC) is a corporation created by the Parliament of Canada in 1970 to stimulate and support scientific and technical research by developing countries for their own behalf. IDRC is funded entirely by the Canadian Parliament, to which it reports annually, its operations are guided by an international 21-member Board of Governors. Under the IDRC Act, the chairman, the vice-chairman, and nine other governors must be Canadian citizens; in practice, 6 of the remaining 10 governors are from developing countries.

Research projects supported by the Centre are identified, designed, conducted, and managed by developing-country researchers in their own countries, to meet their own priorities. The Centre itself does not undertake research, but has a range of expertise across disciplines who advise and assist scientists and national research institutions. There are seven Divisions within this Centre : Agriculture, Food and Nutrition Sciences (AFNS); Health Sciences; Social Sciences; Information Sciences; Engineering and Earth Sciences; Fellowships and Awards; and Communication.

The AFNS program mission statement is "access to food for the individual", the focal points of which are sustainable methods of production and utilisation of renewable resources for the primary benefit of rural households. Within AFNS, there are six major program areas : Agricultural Economics, Crops Production Systems, Animal Production Systems, Fisheries, Forestry and Post Production Systems.

The animal production systems program like the crops program, has strong emphasis on whole farm systems research. Small ruminants (goats and sheep) represent one of the priority areas for research and development.

THE PROGRAM

Increased attention to support research and development of small ruminants (goats and sheep) is an important new initiative. The objectives include research on the complex interactions between the environment and animals based on a systems approach, assessment of potential productivity in breeds, overcoming existing constraints, problems of producers and consumers, the development of institutional and research capacity and dissemination of information and appropriate technology of direct benefit to farmers.

The criteria for research support takes cognisance of the following specific issues :

- The nature and importance of the problem
- Problem is a national priority
- Research feasibility within a time frame
- Potential benefits, impact and contribution to solutions
- Application of results within existing systems
- Alleviate rural nutrition and poverty
- Have regional relevance

An important dimension concerning the development of projects concerned with small ruminants is a detailed assessment of the socio-economic relevance of their ownership and utilisation. This approach addresses large, in depth investigations on patterns of production, contribution to income and human nutrition, constraints, perceptions of farmers, marketing aspects and economic importance of production. Such kind of work is necessarily long term and needs to be done year round to accommodate seasons. This approach is also likely to contribute to a better understanding of the value of individual breeds.

Special focus has been given to Asia in view of the presence of relatively large goat and sheep resources :

Goats : 208 millions, 45% of world population, 1.4% annual growth rate.

Sheep : 185 millions, 16% of world population, 1.0% annual growth rate.

In terms of contribution, both species make a very valuable contribution to various primary and miscellaneous functions, especially to several million small farmers, peasants and landless agricultural labourers.

WORKSHOPS

In order to assess the current status of goats and sheep, identify the constraints to production and establish the nature and priorities for research and development of the species, three important Workshops have been organised, the last two of which were held in 1988.

1) Workshop on Small Ruminant Production Systems in South and South East Asia, October 1986, Bogor, Indonesia (IDRC-265e).

2) Workshop on Goat Meat Production in Asia, March 1988, Tando Jam, Pakistan (IDRC - 268e).

3) Workshop on Sheep Production in Asia, April 1988, Los Banos, Philippines.

These Workshops have helped to promote a sharper definition of problem focus, within national programs, priorities for research and development, research and institutional capacity, promotion of communication between scientists and the dissemination of

information and research results. In addition to these, support has been given for a national meeting in the Philippines, and others that are being planned in China, India, Thailand and Malaysia.

PROJECTS

Currently IDRC supports research and development of small ruminants in all regions : Latin America, Africa, Near East and Asia. The research examines issues related to extensive, nomadic and transhumance systems in Latin America, Africa, the Near East, and South Asia, and those involving arable and tree cropping systems in South East Asia.

Presently a total of 13 projects are supported world wide, of which 8 are in Asia. The annual budget allocation for supporting research in small ruminants is about $800,000 Canadian.

THE PROPOSED NETWORK

IDRC's initiative in setting up the network for small ruminants in Asia is essentially aimed at providing research support, building research capacity and accelerate information exchange. This is specifically in response to repeated requests, strong support and interest expressed by national research programs and also by several donor agencies. It is hoped that the formation of the network will enable the following :

- Increase effectiveness of national research program
- Encourage more realistic definition and pursuit of research priorities
- Provide assistance and possibly also sources of funding for defined priorities
- Accelerate information exchange and interaction among scientists
- Encourage communication among small ruminant scientists
- Organise appropriate training activities and meetings
- Regulate the efforts of national program and support by donor agencies
- Ensure maximum use of all available resources

JAPAN INTERNATIONAL COOPERATION AGENCY (JICA)

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INTRODUCTION

The task of Japanese technical cooperation is the "development of human resources" for the nation building of the development countries. In other words, technical cooperation who are technically capable of taking a positive part in the national task of economic and social development.

All the Japanese technical cooperations are operated in response to the request from the Governments of developing countries or the international organisations.

FUNCTIONS

JICA, the official agency of Japan, was established with a view to promoting international cooperation for the social and economic development of developing countries.

The total budget of JICA for the fiscal year 1988 was US$ 835 million.

The functions of JICA cover a wide range which is as follows :

1) To extend technical cooperation to developing areas on a governmental basis.

2) To carry out the work necessary for the promotion of the overseas cooperation activities of Japanese youth (the Japan Overseas Cooperation Volunteers - JOCV).

3) To promote Japanese private enterprises with funds necessary for the improvement of facilities related to social and economic development as well as funds necessary for pilot projects.

4) To facilitate emigration to Latin America and other areas.

5) To recruit and train qualified personnel for technical cooperation.

6) To extend grant aid project.

In order to carry out these various activities, JICA has 18 departments in its Head Office in Tokyo, 9 branch offices all over Japan, 47 overseas offices in 43 countries and affiliated organisations

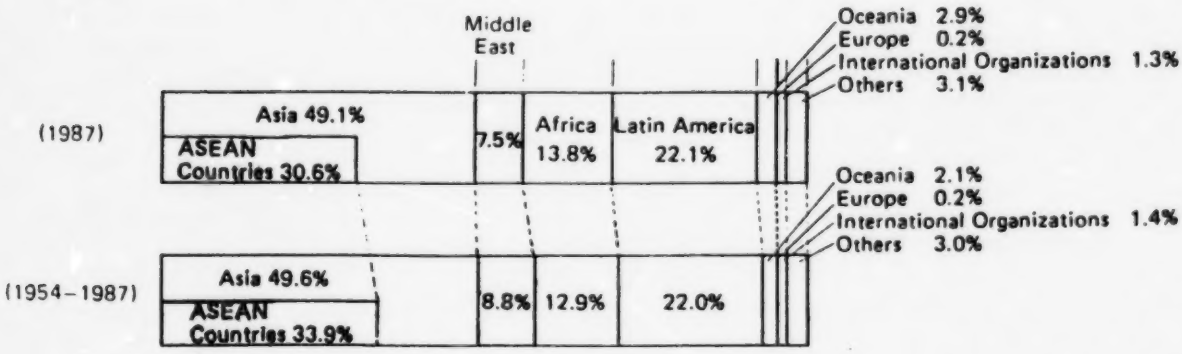
such as International Training Centres (10 at present), Institute for International Cooperation and so forth.

JICA'S MAJOR PERFORMANCE

Figure 1, the expenses for JICA's technical cooperation by region, shows that JICA is concentrating 50% of its Expenses to the neighbour of Japan, the Asian Region.

FIGURE 1

EXPENSES FOR JICA's TECHNICAL COOPERATION BY REGION IN FISCAL 1987



JICA's TECHNICAL COOPERATION

JICA's Technical Cooperation is divided into the following operations :

Training Program

To provide training for participants from developing countries in the group courses as well as in the individual program.

Besides training in Japan, JICA has organised "The 3rd Country Training Program" in collaboration with the organisations concerned in the developing countries and also "The Friendship Program for 21st Century" which preceeded with the ASEAN Youth to Japan.

Expert Despatch Program

To despatch Japanese experts to developing countries or to international organisations in order to assist them in formulating development plans and projects, conducting research and offering guidance, advice, etc, at the Government Organisations, research

institutes, schools, training centres, etc.

Equipment Supply Program

To supply equipment necessary for the activities of despatching experts and repatriated training participants.

Project-type Technical Cooperation

To integrate into a development project the acceptance of training participants, despatch of Japanese experts and grant of equipment so as to carry out the project comprehensively and systematically from planning to the follow-up evaluation.

Development Survey Program

To despatch survey teams at the request of developing countries for development projects in the public sector such as the establishment of industrial infrastructure, production increase and comprehensive regional development which play an important role in their economic growth.

EXAMPLE OF JAPANESE PROJECT TYPE TECHNICAL COOPERATION

Outline of JICA's Technical Cooperation for :

The Asean Poultry Disease Research and Training Centre (APDRTC)

Objectives of Project :

The APDRTC was set up with the objectives of upgrading the level of research on poultry diseases of economic importance, and diffusing the research results to other Asean countries through the various training programs. Through intensive research activities, the APDRTC is expected to significantly contribute to the development of poultry industry in the ASEAN countries.

The activities of the APDRT project are :

1) Research activities, and

2) Training activities for personnel engaged in veterinary research and services in Asean countries.

Japanese Contribution through JICA

1) Grant Aid Program

Construction of the facilities of the APDRTC is financed by the Grant-Aid Program of the Government of Japan.

2) Dispatch of experts

Long-term experts are dispatched in the field on virology, bacteriology, parasitology, pathology and epidemiology.

In addition, short-term experts will also be dispatched when the necessity arises.

Training of local counterpart personnel is conducted in Japan in the required field.

Provision of equipment - The newly-formed centre has been receiving modern veterinary research equipment and machineries from the Japanese Government under the JICA's technical cooperation program.

Third country training program - A series of training courses open to the ASEAN countries under the JICA's third-country training program.

Necessary arrangements for conducting the courses will be made by Malaysian Government in collaboration with JICA.

Three different courses will be offered at APDRTC; seminar on poultry diseases, a basic and a specialised diagnostic course. A seminar and a course are offered in each year.

The seminar is designed to provide a good opportunity for participants to refresh and up date knowledge on the state of existing poultry diseases in the Asean member countries and to upgrade the technical know-how on disease prevention and control.

SUPPORT FOR RESEARCH AND DEVELOPMENT ON SMALL RUMINANTS BY GTZ

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ABSTRACT

The importance of small ruminants for rural development increases as farm size decreases. Extension services should pay attention to all aspects of the production system, to the improvement of feeding, hygiene and general husbandry. In this context, the management of small ruminants has to ensure that environmental damage is avoided. While production for subsistence is important, the sale of surplus products increases incomes and purchasing power of the population in rural areas. In order for sheep and goats to play a part in rural development appropriate production systems must be designed based on local research and disseminated in the form of extension materials that have been tested prior to distribution. Improved coordination and cooperation of small ruminant research activities with bilateral and multilateral donors and with national and international organisations and institutions is crucial so as to avoid losses due to friction and to equally avoid duplication of work. We see cooperation with national and international agricultural research institutions in our partner countries as a significant part of the promotion program, to harness scientific potential to a greater degree than has been the case to date for the cause of small ruminant development.

INTRODUCTION

Small ruminants are a realistic animal husbandry option as a source of income or as a way of increasing income, particularly in view of the small area of land required and the fact that these animals make use of fodder which is not suitable for human consumption.

Small ruminants are suited as almost no other domestic animal for integration into smallholders' activities and those of landless families. They have a multitude of uses, producing a large number of varied products such as milk, meat, skins, hides, hair or wool and dung.

If we look at research topics in the field of small ruminant development in tropical and subtropical areas, however, it rapidly becomes obvious that very little work has been done in this field. This is compounded by the limited financial resources available to deal

with a large number of as yet untackled subjects. For each individual country, but also for international organisations, a coordination of research with subsequent exchange of experience is becoming more important than ever before. The research activities in the field of small ruminants totalling some 400 - 600 projects are not yet too numerous to gain an overview.

The following contribution aims to illustrate briefly the global strategies and the future direction of the small ruminant research and development activities of the Deutsche Gesellschaft fur Technische Zusammenarbeit (GTZ) and to look at the development of a Euro-African Small Ruminant Network with the objective of coordinating the information flow and support to research activities.

GLOBAL STRATEGY OF THE GTZ IN SMALL RUMINANT DEVELOPMENT

Between 1982 and 1987 (inclusive) the Federal Republic of Germany made available a total of DM 298 million for some 89 animal production and veterinary medicine projects within the scope of technical cooperation. Of these 59.4% were accounted for by animal production and 40.6% by veterinary medicine measures.

The regional emphasis of this cooperation lay in Africa, where 63.3% of all project funds are going. Asia came second with 26.5%, followed by South and Central America with 4.1% and Europe with 2%. 4.1% of funds were earmarked for supra-regional projects.

Small ruminant projects, totalling 13 are second in number only to cattle projects.

The GTZ's primary considerations when selecting projects are food security and rural development, with Africa as priority region. Technical cooperation is intended to help satisfy basic needs, in other words :

1) To develop natural and human resources through research and training.

2) To promote less developed regions.

3) To promote the social and economic integration of disadvantaged sectors of the population.

In order to find solutions to these challenges some important key principles should be mentioned :

1) Economic growth should increasingly be stimulated through promotion of integrated production systems.

2) Small ruminant production methods should be adapted to rural economic and natural conditions.

3) Natural resources should be used carefully in order to ensure their long-term availability.

4) The lack of adequate and appropriate technologies necessitate an increase in adaptive research.

5) Self-sustaining development should be supported by the participation of the target population in planning, implementation and evaluation of development activities.

As regards the target group and the resources it has at its disposal, it must again be mentioned, however, that the absolute objective is, through extension and advisory services to put the small family farm in a position to achieve higher performance from its animals. Key elements for this include fodder, animal hygiene and health and proper management.

The often extremely limited agricultural land available and the feeding habits of small ruminants give them a special place in the overall range of productive livestock.

Along with the results of analyses of constraints and bottlenecks, small ruminant promotion concepts must take into account the prevailing economic structures in the country :

1) Measures to improve prevailing general conditions for the smallholders (regional and sectoral) must be integrated into the program.

2) Service facilities (veterinary care, markets, training) must be in line with the regional economic level. Small ruminant development can in various ways contribute to the net production and the development of rural areas. A distinction is made here between animal husbandry in marginal areas as the only possible utilisation of natural pastures or existing natural environment.

3) Small ruminants keeping as an integral part of farming activities to utilise otherwise non-utilisable fodder and agricultural by-products.

WHAT ARE THE PARTICULAR CHARACTERISTICS OF PROJECTS TO PROMOTE SMALL RUMINANTS?

Before answering this question I would firstly like to take a look at some statistics. In the mid 1970s, there were two projects in which sheep and goats played a role - one in Latin America, and one in east Africa. In 1985 alone, the GTZ implemented 6 purely sheep or goat projects in Asia (Sri Lanka) and Africa (Algeria, Burundi, Cte d' Ivoire, Tunisia, Morocco). By the end of 1988 these had been joined by another 10 projects (in Brazil, Colombia, Malawi, Malaysia, Niger, Portugal, Rwanda, Somalia, Togo), within the scope of which project components to increase meat and milk production are contained.

This development over the last ten years, which is mirrored generally in the international scene, speaks for itself.

GTZ RESEARCH - APPROACHES AND KEY AREAS

The GTZ has at its disposal experts with a great many years' experience in the field of international technical cooperation and can always recruit the services of German and non-German consultants to

implement special projects. The Animal Production Division works closely with universities and institutes in the Federal Republic of Germany and abroad and with other international organisations.

To help it to work out extension programs, the GTZ is carrying out research and development programs in the small ruminant sector. These are intended to gather practice-oriented, scientifically processed information and to translate this into practice.

The strategic research approach has two prongs:

1) the methodical research approach, and

2) research approaches within the discipline.

Methodical Research Approach

After many years working with small ruminants, in particular goats, the need for a more targeted, better coordinated research to solve the problems confronting us is pointed out again and again.

An important principle to respect here is that research approaches must be planned as programs appropriate to the system in which they will be implemented. The second vital principle is that innovations should only be introduced once they have been thoroughly tested in pilot projects.

Research Approaches within the Discipline

It is pragmatic and realistic to make use of available research capacity in the traditional disciplines :

a) Health and hygiene

b) Feed and fodder

c) Reproduction and breeding

d) Prevailing socioeconomic conditions

where planning for each individual research project is integrated into a well-thought out strategy and where there can be an appropriate exchange of experience.

Thereby priorities should be worked out within each of these disciplines with regard to their significance for individual ecological zones.

Taking the example of the humid and subhumid zone of Africa here are the research priorities as planned in the GTZ :

Economic and Socio-economic Context

Before priorities for research projects are determined, the problem must be viewed in the context of the prevailing socio-economic conditions. This is vital if research is to be conducted into small ruminant development. The economic context is however, not only

important during the planning phase, but also during the entire implementation phase of a research program.

Feed and Animal Nutrition

A top priority in formulating research projects in humid and subhumid areas; the following are the key points:

a) Fodder resources
b) Fodder and nutrient requirements
c) Range and herd management.

Animal Health

The second research priority is animal health. Epidemiological research (ecopathology) is needed to improve the health status of small ruminants. Economic weighting can give practical measures with a good return on inputs.

Animal Production Techniques and Animal Breeding

Animal husbandry technology includes the development of appropriate methods of breeding and keeping young animals, milk production and feeding techniques. Breeding questions should be limited to the research into genotype-environment interactions, the analysis of well-performing local populations and the definition of selection parameters and targeted mating.

Crossbreeding with imported races should only be performed under certain conditions and research work to improve biotechnical measures (artificial insemination and embryo transfer) are not priority activities.

REGIONAL STRATEGY AND PRIORITIES OF GTZ RESEARCH

If we distinguish between research tasks according to the potential of the production location, the priority in extensive livestock breeding is the improvement of meat production, while with increasing intensity of the production system, milk and lamb production become increasingly important. Along this, investigations should be conducted into range management, feeding, breeding, husbandry and hygiene and the production and processing of products. This intentionally wide-ranging framework is made vital in conjunction with intensifying of small ruminant production by the necessity for this branch of animal production to make its contribution to maintaining a stable ecosystem.

Agricultural economic investigations, closely linked to work on production technology, have been carried out in Peru and in the Mediterranean countries (Turkey, Cyprus, Jordan, Syria, Tunisia and Morocco). The need for reliable data and practical experience in small ruminant production led to the establishment of an extensive research project in Tunisia.

In this project, a vast quantity of information and data on production locations, forms of goat keeping, goat products and the prices of these products and production factors is being recorded so as

to draw up a typology of goat keeping according to location. A project implemented jointly with the Berlin Technical University and the University of Malaysia concentrated on the efforts of breeders to increase performance in meat and milk production. Various degrees of intensity in the animal keeping, in particular during the rearing phase were analysed with regard to their impact on the performance level achieved with the aim of defining the optimum form of smallholder goat keeping in East Asia.

In Burundi and Sri Lanka, the first steps have been made to developing goat keeping as an important economic activity in a disadvantaged region. The objective of this project is to improve the local goat population by crossbreeding with a high-performance breed and optimising husbandry conditions. At present projects involving small ruminants are also being implemented in Malawi, Bangladesh, India, Pakistan, Lesotho, Sao Tom and Cap Verde - conclusive evidence of the increase in status of an area of animal production which has been largely ignored to date.

In conclusion, it should be noted that the approach taken by the research project in Tunisia has proved attractive and appropriate, not only for the prevailing conditions there. Rather it is becoming a typical project approach for programs in areas with similar general conditions.

Having said this though, the GTZ does not have the perfect extension concept on tap. The concept must always be adapted to bring it into line with the specific conditions of any given country, and indeed the specific region of a country. This necessitates investigations, the results of which will be processed and made into extension programs. This type of work has already been performed in Burundi, Malawi and Sri Lanka, to name only a few examples.

All project results available to us at the present time concur that sustainable improvements in performance cannot be achieved exclusively (and certainly not primarily) by breeding improvements or gene transfer. In most cases improved fodder supply, health care and management lead to such significant and lasting improvements in performance, that the whole question of whether costly gene transfer is economically defensible should be rethought.

The following areas of research are thus the most important when compiling an extension program :

1) The contribution of sheep and goat keeping to human nutrition and to the family income.

2) Integration of small ruminants into smallholders' activities to increase and maintain soil productivity.

3) Combined husbandry systems for ruminants - sheep/goat, cattle/buffalo and their impact on vegetation and overall performance

4) Geoecological investigations to determine the range capacity.

5) Evaluation of the performance potential of local populations and crosses.

6) Endoparasite control measures.

7) Measures to improve production and rearing performances of the local population.

8) Breeding measures to increase milk and meat production, identification of high-performance breed for crossbreeding.

9) Measures to improve the quality of skins and wool.

10) Organisation and economic viability of milk production using small ruminants.

WHAT CONCLUSIONS SHOULD BE DRAWN FOR PROMOTION MEASURES?

In general the maxim holds true that increasing population density and/or scarcity of land results in a development which makes animal production indispensable if agricultural productivity is to be attained. Measures to promote small ruminants can, in this situation, be used as an instrument of rural development. This is however only possible when one takes into account the fact that small ruminants can only continue to make a valuable contribution to the development of rural areas if the scientific work on basic issues involved continues.

With reference to our subjects, these remarks on the strategy of small ruminant development indicate that improvements can and will only be achieved if those who own and manage sheep and/or goats are ready and willing to cooperate. That was one point. Another point refers to planners and designers. Sustainable success is not possible in any project if the major constraints and underlying factors which determine the present unsatisfactory level of production are not recognised and pinpointed by the people themselves. The principle of participation is the key to successful cooperation. Which brings me to make a few points on the basic principles of the small ruminant development concept and on experience gained to date.

Resources

We must accept the fact that livestock development strategies are not only technological methods of increasing production on a per hectare or per head basis, but that livestock development will only benefit the livestock-owning community if the natural conditions are at least maintained if not improved at the same time. Environmental management is closely linked to goat production, for example.

Breeding

It is important to familiarise oneself with local breeds and their genetic make-up before deciding on a breeding strategy, especially before crossbreeding is initiated. Different approaches are necessary to achieve different objectives, since the heredity of beef and milk traits varies considerably.

Health

Since in various countries there is not a sufficient number of field staff available to actually reach the livestock owner, a new

approach has been developed - the auxiliary animal health care program.

This aims at transferring basic preventive measures and fairly simple technologies down to the grassroots level. This is still a new concept and at present initial steps are being taken to implement it.

Management

Livestock management, animal health and animal nutrition are closely linked. Nevertheless, the demand for improved management systems appropriate for the natural conditions and adapted to the traditions of the target group in question is an important aspect. Special attention is paid to the changeover from meat production to milk production which entail organising collection and processing of dairy products.

Any further increase in animal production must be achieved primarily by intensifying existing production systems rather than by increasing animal numbers.

As a consequence, projects must have the following characteristics:

a) **A multi-disciplinary approach**

Integration of cropping and animal husbandry adapted to suit farm size, demand, the market, soil conditions and water availability.

Development of multidisciplinary extension services for demonstration and extension of technically and economically integrated farm systems.

An intensification of health care and development of appropriate and cost-conscious methods for prevention and treatment of diseases.

b) **Manpower development and research**

Experience shows that projects and programs must be very flexible as regards inputs and that they require a higher level of more comprehensive specialised know-how. This implies better and wider reaching technical solutions as well as higher, multi-disciplinary standards of expertise at academic and producer level. More attention will thus have to be paid to manpower development and specialist training, adaptive research and development of improved appropriate technologies, elaboration of integrated concepts, strategies and programs and their extension into production practices.

c) **Ecology and environment**

There are numerous examples of an inappropriate production system resulting in the severe degradation of the natural environment. If we are to maintain an environment which can offer a livelihood to the generations to come, more attention will have to be paid to environmental protection. Methods must be developed to allow us to assess and quantify the environmental impact of livestock

projects. If properly used in project planning this could make a valuable contribution to a better, more sustained utilisation of natural resources.

So, we can now say that the three most important aspects to be borne in mind when deciding whether or not to promote small ruminant production are:

1) Small ruminant production should only be promoted where efforts are being made to better exploit existing reserves giving due care and attention to environmental impact and ensuing that natural resources are maintained.

2) Promotion must benefit the priority target group - smallholders, the landless and the urban poor.

3) Research in this sector must be practice-oriented and as far as possible aimed at the complete production process.

Successful research work depends on problem recognition, exchange of ideas, critical assessment of results, demand (finance) and on effective research management. In the latter, a development organisation such as the GTZ has a major role to play.

WHAT ARE THE EXPERIENCES TO DATE?

Since sheep and goat were discovered some ten years ago as important species for rural development in tropical and subtropical areas, independent attempts have been made everywhere to increase the level of knowledge on sheep and goat production through research, without first checking whether work had already been done on a specific topic.

A handful of experts have produced results, some of which are not comparable or cannot be transferred. It can be seen from a duplicity of results that the same topic has been tackled by several different research projects - particularly unfortunate in a field with very limited financial resources and where, despite the research work which has been performed, we still know too little.

It has also become clear that the potential of European institutes for cooperation is doubtless greater than the requirement. Yet there are still a great many excellent institutions and scientists working on topics relevant to tropical areas who have no contact with international centres. There is a great need for coordination of research work and greater contact between researchers in Europe and in developing countries. One of the GTZ's tasks over the last few years has been to develop the conceptual framework and initiate coordination of institutions working in development and research institutes. A first success was recorded in 1986 when a conference on the theme "Coordination of Small Ruminant Research for Development in Africa" was held in Montpellier. Initiated by the GTZ, it was organised jointly by the GTZ, the European Community , the CTA (Centre Technique de Coopration Agricole et Rurale) and the IEMVT (Institut d'Elevage et de Medecine Veterinaire des Pays Tropicaux.

The major result of the conference was CTA's decision to hold an informal meeting once a year for about twelve international donor organisations interested in the promotion of small ruminants.

A Euro-African Small Ruminant Network (REAPER) has also been established, with its secretariat at the GTZ. REAPER is not a research organisation which produces new knowledge or technologies, neither is it directly involved in project formulation and implementation, rather it aims to establish, in the initial phase a platform for efficient services, intercommunication and linkages to and among the institutions and specialists working in small ruminant research.

Once the network is established, REAPER is to focus on building up a service unit for :

1) Strengthening the research into African development through improved communication among European researchers, between North and South Africa, between scientists in East and West Africa using different languages and establishing a better liaison with the ILCA network for European institutions and researchers;

2) Providing clearer guidelines to the program of science and technology for development (STD) of the European Community and donors on priorities to set when setting up small ruminant research and development projects and thus generate more investment into research and development of livestock production based on small ruminants.

Mandate:

3) The network concentrates on African countries, but does not deal with Africa to the exclusion of requests for information from and communication with researchers in other parts of the world. It devotes itself to generating an increased volume of effective research work through coordination and concertation of small ruminant research in Europe and Africa in conjunction with international centres and development agencies regardless of whether this research may be funded by STD or by other sources, in particular national bilateral sources.

It translates development problems into research and connected activities (training) and facilitates the transfer of research into development.

It organises the permanent updating of an inventory of small ruminant research, with particular emphasis on European and African research teams, but also including relevant work carried out elsewhere.

It makes research findings available to researchers and developers through appropriate publications and seminars or workshops.

It identifies possible funding for small ruminant research and continuation of the network itself and attempts to involve more European institutes.

Organisation and Operation

a) The GTZ coordinates cooperation within the network. During the initial phase the GTZ, IEMVT and ITMA are joining forces in conjunction with CTA.

b) Scientific committee: a scientific committee will guide and supervise the execution of the network and act as an advisory body for STD -2 - Small Ruminant research. It will comprise three African scientists and representative of IEMVT, ITMA and the GTZ.

c) Elements of the network : The elements of the network are tools provided as services for researchers

These tools include workshops, research and training grants and the seed money scheme.

d) Operation: REAPER complements ongoing activities in the small ruminant sector, making use of existing information networks, data banks, training facilities such as FAO Sagin and its regional networks SPAAR, IBAR and others. It is vital that we coordinate our work with and complement the activities of ILCA-SRMMT focusing on European partner participation in relevant research and that we carry out workshops jointly.

The organisation of the effective diffusion of scientific and technical information to each of the African countries presents us with a great challenge because of the diversity and nature of the information needed for the agricultural and rural development of each individual country. The network activities are thus perforce concerned with major development topics. Information on these topics will be collected and disseminated so as to reach as large an audience in as many countries as possible.

The medium-term objectives of the network are :

1) To help African countries gain easier access to the results of work carried out by the national, regional and international bodies involved in small ruminant development.

2) To help organise meeting of specialists, research planners and development staff so that they may exchange experience gained in specific ecological environments.

3) To encourage regional cooperation in the exchange of information on small ruminant development.

4) To break down the linguistic barrier by translating work considered to be important for small ruminant experts and technicians in African countries.

5) To make REAPER not only an institution to relay scientific and technical information regarding small ruminant development, but also, at least in the long-term, to make it a forum which can assist the EEC and African countries to develop a better concept of effective assistance to small ruminant development in Africa.

CONCLUSION

The discussions on the situation in individual countries and on new approaches have certainly promoted a better mutual understanding and the dialogue will continue. The recommendations for an improved strategy will serve as a valuable basis for work in these countries and for the contribution we can make. You may be sure that the GTZ will do its best to implement the recommendations.

THE SMALL RUMINANT COLLABORATIVE RESEARCH SUPPORT PROGRAM : FUTURE NETWORKING OPPORTUNITIES

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INTRODUCTION

Fifty-three percent of the world's sheep, 94% of the world's goats and 100% of the Andean camelids are distributed in the developing countries and are owned primarily by small pastoralists and farmers of very limited means. Despite their low production, these animals contribute very significantly to the economy and food supply in these regions and demand for their products exceeds the supply.

Improving the performance of small ruminants would directly improve the diet and standard of living of a great many people because the animals are inherently well suited to the needs of the smallholders and to the conditions prevailing in the developing countries.

Focusing on these consideration in 1978, the United States Agency for International Development (USAID) implemented the Small Ruminant Collaborative Research Support Program (SR-CRSP) in an effort to strengthen the research capabilities of U.S. agricultural research institutions and thereby assist U.S. international efforts to help solve food and nutritional problems of developing countries.

The primary goal of SR-CRSP is to improve meat, milk, and fiber production from sheep, alpacas, and goats to increase the food supply and raise smallholder incomes. Another major objective of the program is to strengthen the research capacity of overseas and U.S. agricultural research institutions.

In order to meet its objectives, the SR-CRSP implemented a multidisciplinary strategy designed to help alleviate some of the major problems that severely hinder small ruminant productivity in the developing countries. In doing so, the program identified the following production problem areas and associated disciplinary research lines that defined the SR-CRSP structural framework:

Problem Area	Research Area
Insufficient year-round feed supply	Nutrition, forages, and feeding
Improper grazing practices	Range management
Disease-parasitism	Animal health

Problem Area	Research Area
Poor reproductive performance	Research on reproduction in the male and female
Non-selective breeding	Genetic improvement of local breeds and crossbreeds
Suboptimum utilisation of available resources	Management
Production unit constraints and policy issues	Socio-economic research
Lack of coordination and integrated improvement efforts	Systems research

STRUCTURE AND WORK SITES

Matching problem areas to specific research areas, the SR-CRSP defined its structural organisation on the basis of an administrative unit called the management entity (University of California, Davis) and 12 component research projects located at 10 U.S. universities and research institutions, including:

Institution	Research Project
University of California, Davis	Breeding
Colorado State University	Animal health
University of Missouri-Columbia	Rural sociology
Montana State University	Breeding
North Carolina State University	Animal nutrition
Texas A&M University	Systems analysis and animal breeding
Texas Tech University	Range management
Utah State University	Range management
Washington State University	animal health
Winrock International Institute for International Development	Economics and production systems

Each of the above institutions designated a research coordinator or principal investigator (PI), for each of the research components.

Because the overseas research component of the SR-CRSP was considered the cornerstone of the program, great care was taken to select appropriate overseas worksites that meet the following criteria:

1) The sites should be representative of the various ecozones and production systems associated with small ruminants such that the applicability of SR-CRSP research findings could be extended to any country or area with similar climate and topography.

2) The countries in which the sites are located should have established agricultural institutions, staffed by scientists,

trained personnel, and students, with whom SR-CRSP investigators could have an opportunity to collaborate. These institutions also should provide the extension links that are pivotal to the implementation of SR-CRSP findings.

The current overseas sites, collaborating institutions, and corresponding ecozones are:

Country	Collaborating Institution	Ecozone
Brazil	EMBRAPA: Ministerio da Agricultura Empresa Brasileira de Pesquisa Agropecuaria	Hot, dry tropics
Peru	INIAA: Instituto Nacional de Investigacion Agraria y Agroindustrial	Cool, dry, high altitude tropics
Indonesia	AARD: Agency for Agricultural Research and Development	Lowland, high rainfall tropics
Kenya	KARI: Kenya Agricultural Research Institute	Cool, subhumid, 1500-2000 M altitude tropics
Morocco	IAV:Institut Agronomique et Veterinaire, Hassan II University,	Semi-arid, Mediterranean, low to mid altitudes.

INTER-RELATIONSHIPS BETWEEN SUBPROJECTS

The grant agreement with USAID specifies the research objectives for the overall SR-CRSP program in only the broadest terms. This has allowed considerable flexibility in the program, ranging from establishing specific research objectives to designing the operational components of the program. This feature was of particular value when worksites and overseas collaborating institutions were subsequently selected. It enabled the program to meet the differing circumstances of each country, such as the state of existing livestock, production systems, the institutional setting, and government policies.

In Kenya and Indonesia, research development was oriented towards offering smallholders production and management information needed for reducing severe constraints and to maintaining a sustainable small ruminant production system. It has meant that research agendas of subprojects have had to be interrelated into a multidisciplinary research coordinated activity. This integrated mode of operation is one which is also in harmony with the needs of the Kenyan and Indonesian collaborating institutions.

In the three remaining worksites (Brazil, Peru, and Morocco), research was also aimed at reducing constraints in existing production systems to improve their low productivity. However, the interdisciplinary relationships are considerably less integrated than is the case in Kenya and Indonesia. This is partly because of the nature of the problems being tackled, but in part also a result of institutional circumstances.

MAJOR ACCOMPLISHMENTS

The SR-CRSP has conducted research for almost 9 years. In each of the five host countries, the program has supported concurrently numerous research efforts. Projects have ranged from highly focused disciplinary attempts to solve specific problems to broadly based team-oriented, interdisciplinary field studies. Much of the work involved cooperative efforts among scientists of various disciplines.

Equally important has been the collaborative emphasis between SR-CRSP and host country scientists. In each project, they jointly planned, implemented, and evaluated the research. Much of the success of SR-CRSP can be attributed directly to the participation of host country scientists, including many trained in the program.

Numerous projects required long-term (5 to 10 years) research agendas before yielding results. Some projects only now are beginning to provide answers. Data from other projects became the basis for ensuing research and for long-term potential benefits and for contributing to the body of knowledge. Some projects of shorter duration already have provided information of direct practical use to producers.

Examples of results with immediate practical applicability have included:

1) Development in Kenya of a composite breed dual-purpose goat (DPG) for milk and meat production in higher potential farming areas. Though another 3 to 5 years are needed to fix the breed genetically, the work has combined successfully into a single stock two locally adapted meat breeds and two imported dairy breeds. The introduction of dual-purpose goats and of improved forage production practices has resulted in a 66% increase in food yield from goats for smallholder families. Each DPG generates an average of US$ 52 additional income per hectare. Assuming that only about 10% of the humid and subhumid zone in Kenya would be available for food crops and fallow, the potential benefits would amount to $2.5 million annually.

2) Development of a high prolific strain of Javanese Thin-Tailed Sheep in Indonesia. This strain yields an average litter size of 2.8 lambs/litter, nearly double the average litter size in West Java. For the 3 million sheep being kept in this province, this means an average increase in sheep production of 1.5 million sheep per year, adding $18 million per year to the revenues of sheep farmers.

3) Demonstration that the Moroccan D'Man breed of sheep transmits its high prolificacy additively to first cross and backcross progeny. This makes it possible to use local genetic resources to increase prolificacy in Moroccan sheep to different degrees, in accord with requirements of management and feeding systems. If 10% of Morocco's 10 million ewes were replaced with D'Man crosses, it is estimated that this would generate US$ 5 million in additional gross annual income to producers.

4) Development of a new vaccine against contagious caprine pleuropneumonia (CCPP) in Kenya. This epidemic disease affects at least 48 million goats in Africa and Asia and, if untreated, has a mortality rate greater than 80%. The vaccine is safe, easily stored, economical to produce, and highly efficacious. If Kenyan producers used this vaccine widely, it would prevent an average of 82 annual local outbreaks involving an estimated 300,000 goats.

5) Demonstration in Indonesia that supplementation of tropical grasses improved growth and reproduction of Javanese Thin-Tailed sheep and growth of Kacang goats. The supplementation consisted of a complete mineral mixture plus a low fiber feed, practices that village farmers could supply at low cost. Adoption of improved practices for the use of green legume foliage led to weight gains of 120% and increases in feed efficiency of 80%.

6) Demonstration that forage production in Brazil's semi-arid forest regions was enhanced through vegetal manipulation. Thinning tree canopies resulted in significantly more forage biomass produced beneath the trees. It also was determined that a partial clearing of the canopy was just as effective as complete clearing. Increases of up to 800% in herbaceous vegetation on the ground were obtained by totally clearing the tree canopy. Grass production especially was improved by this practice, increasing its proportion of the total herbaceous plant yield from 1.7% to 10%.

7) Identification of the competitive and interactive grazing behavior of sheep, alpacas, and llamas on Peruvian highland ranges. Alpacas, having the most opportunistic feeding strategy, compete directly with llamas and sheep when range conditions vary; llamas and sheep can be grazed together, while alpacas are best managed alone. Moreover, research demonstrated that properly used, cultivated forages could boost animal production by 15 to 20%.

8) Identification and control of caprine arthritis encephalitis viral infection in Kenya, Peru, and other parts of the world. It was determined that viral transmission occurs through colostrum and milk, and methods were developed to prevent its spread. These control methods are important for the United States, where about 80% of dairy goats are affected. The control of this disease represents a US$ 20 million savings for goat producers worldwide.

9) Identification of nutritional myopathy among sheep. In Morocco, it was determined that this condition, previously unrecognised in the region, resulted from a dietary deficiency in selenium. Methods for correcting the deficiency previously developed in the

United States were tested and found completely effective in Morocco.

10) Finding that the dominant proportion of the livestock produced by highland peasant communities in Peru is raised in agropastoral communities, not almost exclusively by pastoral communities, as previously thought. This finding will change the course of agricultural development strategies in the poorest Andean countries. Furthermore, the research established that livestock in highland Peruvian agropastoral communities are valued most for the dung they provide (for use as fertiliser) rather than for their meat, fiber, or cash value.

11) Developed a grazing scheme for sheep under rubber trees in Sumatra, Indonesia, that has reduced weed infestation as well as the use and cost of herbicides by 50%. Research is underway to test the possible uses of processed rubber seeds, an overlooked and potential source of energy, as a supplement for sheep and to improve genetically the local sheep with hair sheep breeding.

12) Demonstrated that rural women in many countries play significant and often primary roles in the care, feeding, and management of small ruminants as well as in making major consumption and distribution decisions.

There are also many examples of the results with long-term potential benefits and contributions to body of knowledge. In the area of degree training, SR-CRSP provided either full or partial financial and technical support through 1988 to over 300 individuals, 240 from 28 developing countries, the balance from the United States. Of those trained, 63 were women, two-thirds of them from developing countries.

NETWORKING

Presently, SR-CRSP is developing a proposal for a 5-year extension beyond 1990. For various reasons, several, but not all of the original sites are proposed to be continued with some modifications. It is expected that research activities in Indonesia, a site representing the humid tropics and South East Asia, will continue under the new extension. On the basis of intensive regional activities, and with emphasis on more formal network development, the proposed extension will capitalise on earlier SR-CRSP efforts that have encouraged and supported the development of communication exchange mechanisms and local networks. In the case of Indonesia, the present small ruminant network has inventoried its human and institutional resources, organised a computerised literature data bank and is about to launch its first newsletter.

The SR-CRSP recognises that its long-term success in aiding the producers of small ruminants throughout the world will be dependent, to some extent, upon the ability of the participating institutions to establish and maintain a Small Ruminant Science Network (SRSN) to support and provide service for:

1) Continuous professional development.

2) Prompt flow and exchange of research results, experience and methods.

3) Mechanisms to facilitate collaboration and cooperation in planning and executing research on a regional basis.

4) Maximising use of available resources, avoiding duplication of research efforts and encouraging research networking.

5) Identification of sources of funds to support research.

6) Increased attention to rapid and efficient transfer of new technology from laboratories and research stations to farmers' flocks and fields.

Experiences of SR-CRSP illustrate both the significance of these topics as well as some of the possibilities for renewed action.

Continuing professional improvement has been and will continue to be an important part of SR-CRSP contributions to strengthening individual and institutional capacities in its host country partners. Scientists trained under SR-CRSP are encouraged to apply and augment their skills after returning to their home institutions. In addition to continuing to develop professional skills, it also is important that they maintain and expand interaction with each other. U.S. institutions also benefit by maintaining professional and personal communication with the most promising prospects for future leadership positions in each host country.

An important accomplishment of SR-CRSP has been the development of extensive collaborative working relationships between U.S. and host country scientists. This was done by (a) establishing collaborative research projects and (b) developing strong professional ties between U.S. based academic advisors and their former students. This pool of experienced host country scientists provides a solid foundation on which to plan and execute new research projects.

Many host country scientists work under conditions of professional isolation and limited technical and financial support. These issues continue to be of concern to SR-CRSP.

SR-CRSP scientists as well as host country scientists periodically have had opportunities to meet colleagues from other countries at conferences or workshops, some of these being co-sponsored by SR-CRSP. Many such interactions have occurred haphazardly without systematic focus, long-term strategic purpose, or little attention to follow-up. Consequently, sheep and goat scientists in various countries are unable to keep abreast of developments, fail to benefit fully from SR-CRSP activities, and do not communicate their experiences or research results to colleagues in other countries.

Where host country scientists operate in research environments that lack sufficient resources, this poses great difficulties, especially for young, newly-trained scientists. Without some

continued professional stimulation and support, the human resources already developed through SR-CRSP in these host countries may be under-utilised or even misapplied. It appears both prudent and productive to fund some research activities of these SR-CRSP collaborators, both building upon and strengthening a professional resource already in place. In some cases, all that may be necessary will be to identify potential sources of funds and to help these young scientists and their institutions prepare appropriate grant proposals.

These and related activities for increasing scientific exchanges among small ruminant scientists and for enhancing their opportunities for research provide the rationale and agenda for development of the proposed Small Ruminant Science Network (SRSN).

NETWORK OBJECTIVES

Networking has proven to be an effective means for overcoming the professional isolation of scientists in various countries and providing for continued professional growth and development. Large networks of scientists are established or being established in Africa by ILCA and in Asia by IDRC. A global network, as proposed here, could be based on existing small networks or upon other regional associations of small ruminant scientists. If feasible, the network should be developed in collaboration with other organisations having similar interests.

The projected minimum set of network objectives includes the following:

1) To encourage small ruminant scientists to conduct research that seeks to solve sheep and goat production problems in developing countries.

2) To develop regional networks of small ruminant scientists that can stimulate interaction and provide peer review of research and teaching activities among scientists in the same region.

3) To encourage and support regional or local efforts in germplasm conservation of indigenous small ruminants as a source for genetic improvement of productivity and to alert government agencies and programs and non-government community on the disadvantages and risks of manipulating non-adapted imported breeds.

4) To connect or link the information/knowledge generated by small ruminant scientists with the efforts of agency administrators involved in development programs. This linkage should also involve private or non-governmental organisations.

5) To stimulate continued professional development by short-term training and to support current collaborative research that already has produced some results but needs additional support for completion or as leverage to obtain funds from other sources.

NETWORK ACTIVITIES

Each regional network would provide a forum for identifying regional constraints to small ruminant production, for developing appropriate methodological strategies to conduct relevant research, for suggesting techniques to interpret research results, for promoting the utilisation, conservation and improvement of local adapted breeds, for disseminating new research findings, and for suggesting agricultural policies that promote livestock development. The regional networks also would translate local research findings into relevant teaching materials and into documents for use in agricultural policy decisions.

Special attention will be given to the inclusion of women scientists in the networks. The significant role of women in animal husbandry has been documented in several of SR-CRSP host countries (Indonesia, Kenya, and Peru), but the participation of women within SR-CRSP research so far has been limited with few exceptions, mainly to the social sciences.

Networks will be region-oriented and based at one of the present host country institutions. Regions with already well-established national research systems, Latin America, Africa, and Southeast Asia, should receive priority for the establishment of the networks. Further, in Latin America SR-CRSP probably would take a leading role in establishment of a small ruminant network, while in Africa and Southeast Asia SR-CRSP network activities might well support already established local networks.

Networks establish working relations among scientists, research institutions, and development agencies. Networks have been especially successful when they have been able to make small research awards for younger professionals to study topics relevant to the needs of development agencies or farmers.

METHODS

The work plan consists of three phases, each involving a regional workshop.

Phase I (year 1) : Workshop to assess the range of researchable topics, listing of priorities, and formulation of terms of reference for invited proposals, composition of complete list of regional small ruminant "stakeholders."

Phase II (year 2): Workshop to screen and approve a limited number of research awards.

Phase III (years 3, 4, 5) Workshops on research results as they become available. During these three workshops, research findings will be communicated to a larger group, and synthesised into farmer or policy recommendations.

Each network will be chaired by a host country scientist, with one of the PIs serving as advisor. Host country institutions will be providing office space, office furniture, communication equipment, and general logistic support. SR-CRSP will fund a bilingual secretary, communications (including a newsletter), and office supplies (including one personal computer, plus a high-quality printer), annual workshops, travel for participants to attend the workshops and for short-term professional development, and research awards.

Short-term professional development for scientists would be provided. These short, 4 to 6 week periods will permit a scientist to visit U.S. universities or research institutions to work with colleagues, to develop new techniques necessary for continuing their research, to bring their bibliographies up to date, and to prepare and discuss materials for publication, etc. Each scientist will prepare a detailed proposal of activities to be accomplished, a project time frame and a final report on completion.

Projects funded might support current research that already has produced some results and which maximised scientific contacts among researchers. Activities funded might range from host country scientists spending professional development leaves in the United States to collaborative research projects in the host countries and support for travel to scientific meetings of high priority. Any activity requiring limited funding ($5,000 to $10,000), and which strengthens already established linkages, would be considered in addition to proposals that may provide seed money or leverage to obtain funds from other sources.

The role of the network secretariat, supported by SR-CRSP funds, would be:

1) To organise and publish a newsletter on a regular basis.

2) To organise and conduct regional workshops on a yearly basis.

3) To organise and keep up-to-date a literature data bank and inventory of human and institutional resources.

4) To be pro-active in organising and applying for additional funds from donor agencies to apply to small ruminant problems identified by workshops or other working groups.

As mentioned above, SR-CRSP is committed to a supportive role in the Asian SRSN assuming that a 5-year continuation of the present program will be approved. All SR-CRSP research institutions are, therefore, looking forward with great interest to the results of this workshop.

WINROCK'S NETWORKING EXPERIENCE IN ASIA

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The primary focus of Winrock International's programs in Asia is to reduce poverty by increasing agricultural production. In this manner, we hope to help Asian countries achieve food security. Winrock's focus is based on the following observations about future problems in Asian countries and other developing countries:

1) Irregardless of Winrock's efforts, many people will still be poor, as well as hungry. Much of that poverty will be linked to limited employment opportunities outside of and within the agricultural sector.

2) Asian countries and other developing countries are becoming more urbanised but, for most of them, the bulk of the population will remain rural and directly or indirectly dependent on agriculture for sustenance.

3) Production increases are possible, but large increases may require new approaches to agriculture in fragile environments.

4) Under pressure from growing populations, the environment is likely to deteriorate further.

5) In most of the developing world, the institutional structures necessary to support agricultural development will continue to be weak.

6) Agricultural development will be needed desperately in most third world countries, and many newly industrialised countries will have much to gain from sustainable agricultural development in the third world.

7) Funds for development assistance from American donors are limited and may not be adequate to meet the needs and opportunities that lie ahead.

The mission of Winrock International Institute for Agricultural Development is to reduce poverty and hunger through sustainable agricultural and rural development. It pursues that mission by working with governments, research and educational institutions, extension systems, operating agencies, and private and voluntary organisations. Winrock works with four groups that sometimes overlap:

1) Beneficiaries: the individuals who are ultimately served by Winrock's efforts.

2) Clients: the organisations Winrock works with to carry out activities that will help the rural poor.

3) Donors: the organisations that provide funds, making it possible for Winrock to work with clients.

4) Associated organisations: institutions with which Winrock collaborates to implement projects.

Winrock focuses on four lines of activity : strengthening agricultural institutions, developing human resources, designing and promoting sustainable agricultural systems, and encouraging the improvement of policies concerning agriculture and rural development.

Winrock is organised to facilitate the pursuit of these four program themes. It has a development studies centre to generate knowledge, four regional divisions to implement projects, and a public affairs and communication division to disseminate information. All of these divisions are supported by the finance and administration division.

WINROCK HAS MORE THAN 30 YEARS' EXPERIENCE IN ASIA

National and international development agencies throughout the Asian region are becoming increasingly articulate on the subject of agricultural research and development. In most countries however, perhaps not unlike the situation in the United States, there remain many scientists and development workers who, in spite of "official" policy, have little understanding of or sympathy for farmer income, profitability, or resource use efficiency. Winrock assists with staff training and management of key national training and research institutions to improve their impact on high resource production areas.

But, Winrock is increasing its involvement in the "downstream" development of upland, lower-resource areas of more fragile environments where social problems abound at the intersect of our expertise in crops, livestock, and trees.

Presently, Winrock has staff in Bangladesh, China, India, Indonesia, Nepal, Pakistan, the Philippines, and Thailand. All these projects involve collaboration with scientists at national universities or national research institutes. Winrock's first involvement in Asia was during the 1950s through the Agricultural Development Council (ADC), one of the three organisations that merged to form Winrock in 1985. The other two organisations were the International Agricultural Development Service and Winrock International Livestock Research and Training Centre. More than 30 years' experience has translated into an excellent awareness among Winrock staff about how the development process works.

As a consequence, Winrock aims at remaining actively involved in the ongoing exchange of ideas and information among participants in international development in Asia.

WINROCK MANAGES NETWORKS IN ASIA

Winrock is involved in four networks in Asia -- three national networks and one regional network. Networks are defined as:

> informal or formal arrangements of cooperation between institutions or persons with similar conditions and problems but without the immediate resources for finding solutions to these problems individually (adapted from Burley, 1987).

National networks are operating in Nepal and Thailand. Another national one is in preparation for the Philippines. A large regional network exists for multipurpose tree crop research and is managed from our Bangkok office.

Thailand: TRIMNET and NORMNET

ADC worked for more than 30 years to strengthen the rural social sciences in Thailand through teaching, fellowships, and research. Building on ADC's efforts, Winrock launched the Thailand Natural Resource Management Program in 1987. The program, which was developed in close cooperation with Ford Foundation program officers, has an important objective : to share the results of applied resource management research undertaken at regional university centres supported by the foundation with the agencies responsible for managing Thailand's resources. Social science professionals trained by the foundation and by ADC represent the core around which current program activities are being built.

A Ford Foundation grant made it possible for Winrock to establish this program. The $350,000 grant was approved for a period of 3 years and started on December 1, 1986. Funds were budgeted for 2 years ($200,000 for 1987 and $150,000 for 1988) on the assumption that substantial additional funding would be forthcoming from the USAID Mission to Thailand. Despite repeated assurances, funds were not provided.

Winrock provided nine fellowships at an estimated cost of $300,000, in addition to meeting overhead and a share of local logistics costs.

In pursuing Winrock's mission of reducing hunger and poverty through sustainable agriculture and rural development this program seeks to assure more equitable access and more sustainable management of natural resources. By strengthening the capacity of Thai professionals to understand the local institutions and traditional arrangements which permit people to manage their natural resource systems, the program is establishing improved models for access to land, water and forests.

These models ensure that the benefits of sustained productivity are more equitably shared.

To conform with the objectives of the grant, Winrock has worked with two regional universities where the Ford Foundation has made sustained capacity-building investments during the past 20 years. Networks have been created to improve the linkages between researchers and action agency decision-makers. Two points have been emphasised:

1) Improving resource management by supporting research which validates alternative management strategies at the field level.

2) Assisting in training young Thai professionals to deal more effectively with natural resource issues.

Funds have been provided through Khon Kaen University to support the Thailand Research in Irrigation Management Network (TRIMNET) and through Chiang Mai University to support the Northern Thailand Resource Management Network (NORMNET)

Through these two networks, one resource focused, the other regionally focused, Winrock has tested the validity and acceptability of the network concept. Results to date have been encouraging. TRIMNET, established through a working partnership between researchers from five universities and the Royal Irrigation Department (RID), has held four workshops. Three of these workshops have combined the sharing of field research results on farmer managed small scale irrigation with actual site visits. These three workshops have involved Thailand's most experienced applied irrigation scholars in a sustained dialogue with RID officials on issues of farmer participation, water-user groups, collection of user fees, and the increasing responsibility for the operation and maintenance of RID-constructed systems being assumed by farmer groups.

NORMNET comprises northern regional representatives of the principal agencies concerned (RID, the Royal Forestry Department, the Department of Land Development, and the National Economic and Social Development Board) who collaborate with researchers from Chiang Mai University's faculties of social science and agriculture, the Social Research Institute, the Tribal Research Institute, and Payap University.

NORMNET has provided the first forum for assessing researchable issues and the resources needed to support the first locally directed applied research program. NORMNET has also sought to identify and involve social science graduates who are members of the Thai highland hill tribe in research related to upland and highland resource management.

Both TRIMNET and NORMNET have initiated programs that provide small research awards to young professionals to stimulate the study of resource management topics relevant to the needs of development agencies. Other activities have included extended program discussions with social foresters, coastal resource management groups, and scientists specialising in irrigated rice farming systems. The objective of these discussions was to determine future opportunities for extending the network approach. Also under discussion are plans for a Northeast Thailand Resource Management Network and a Southern Thailand Resource Management Network to be established during the second phase of this program.

The Philippines: Small Research Awards Program

Since the mid-1950s, ADC and later Winrock, have been involved in agricultural capacity-building strategies. Through the University of the Philippines, Los Banos (UPLB), Winrock had sponsored fellows, worked with UPLB research staff, and provided associates to fulfill

advisory as well as teaching functions in some of the UPLB agricultural units. The institutional relationship that was developed throughout the years revolved around agricultural economics -- understanding the internal dynamics of the agricultural sector, the external factors affecting it as well as policy issues that have a direct or indirect influence on the performance of agriculture, and the accompanying measures that may be employed by policy-makers in overcoming the problems in the sector.

The success of Winrock at UPLB provides a suitable model for similar though perhaps smaller scale, capacity building activities in institutions in other regions in the country. Winrock recently developed a small research awards program for the Philippines. With current issues of development closely allied to agricultural concerns and natural resource management, this program could engender more focused academic activity that is region-specific and more relevant to current policy issues. For several regional institutions, capacity building in this subject area has been minimal at best due to inadequate technical and financial support. Access to this support has been limited for several reasons including the lack or absence of contact with larger, more-developed institutions' academic resource bases.

The proposed Small Research Awards Program is essentially a mechanism to :

1) Provide individuals (especially young researchers, practitioners, planners, scholars, or field administrators) with the opportunity to undertake research on issues related to natural resource management in various regions.

2) Provide regional institutions with the capacity to assume lead roles in determining priority areas of concern, collaborating with action agencies (both public and private), and determining the operational procedures in addressing these are areas of concern.

3) Encourage an integrated or inter-disciplinary approach in the study of natural resource management with emphasis on people's participation in the utilisation, conservation, and management of natural resources.

The following components of the awards program are proposed:

a) Research.

b) Fellowship and training.

c) Seminars, conferences, workshops.

d) Information dissemination and publications.

It should be noted that these components are all interrelated; each one complements the other. For example, initial seminars, conferences, and workshops may serve as forums for increasing awareness on natural resource management. A conceptual framework or a prioritised list of issues for the research component of the program could emerge from these discussions. Research awards will be given on

a competitive basis and will be open to UPLB, other academic and research institutions, and private and government sectors. The fellowship and training components include support for a degree program and non-formal training. The information and publications component will provide a forum for regular release of information on current and emerging issues or policy recommendations on natural resource management. A virtually identical network is already operating in Nepal with funding from USAID and Ford Foundation.

The Multipurpose Tree Species (MPTS) Research Network

The MPTS Research Network is part of the Forestry/Fuelwood Research and Development Project (F/FRED). The F/FRED Project is a 10-year effort designed to help scientists cooperatively address the needs of small scale farmers for fuelwood and other tree products. The project has helped to initiate and support the establishment of the Multipurpose Tree Species Research Network which has some 25 participating institutions in 12 countries in Asia. Mechanisms for network development include scientific and organisational meetings, cooperative research projects, training, travel grants, publications, and small research grants.

The MPTS Research Network is regional, covering most of the non-Communist countries in Asia. However, it is built upon informal, national-level networks which are being established through a series of National MPTS Research Meetings held annually in most of the participating countries. The two primary objectives of these meetings are to provide an open forum for discussion of research issues and to provide national-level links to the regional research network.

The field operations of the F/FRED project have been largely successful in establishing the MPTS Research Network (Butterfield et al., 1988). Activities have increasingly been initiated and managed by network participants with support from F/FRED. Formal and informal leadership of these activities by participants are crucial to long-term network success.

During the first 3 years of network establishment most network activities have been managed by the F/FRED Coordinating Unit housed at the Kasetsart University Faculty of Forestry in Bangkok, Thailand. However, several important subprojects such as a national level network of researchers working on Azadirachta indica and Melia azedarach and a regional research program on the leucaena psyllid have been initiated, coordinated, and managed by network participants.

The management role of the Bangkok-based coordinating unit has included two closely related, yet distinct projects: the F/FRED project funded by USAID and the MPTS Research Network which is largely funded by the F/FRED project. As cooperative relationships are built during network establishment, the tasks of the coordinating unit are shifting to emphasise network coordination and to broaden the base of network support. Symbolic of this effort was the change in the name of the network from the F/FRED Research Network to the MPTS Research Network. With this shift has also come additional co-sponsorship of activities with other donors, including the International Development Research Centre (IDRC), the German Agency for Technical Cooperation, Ford Foundation, the Food and Agriculture Organisation of the United Nations, the Australian Centre for International Agricultural Research,

the Finnish International Development Cooperation Agency, and the Commonwealth Scientific and Industrial Research Organisation.

TO BE SUCCESSFUL, NETWORKS MUST BE CONSTANTLY REEVALUATED

Table 1 lists the critical elements for successful networking (MacDicken, 1989). These elements can be summarised as follows:

1) An active core of participants.

2) Management of conflicts of interest.

3) Flexibility of project support.

4) Neutral institutional base.

5) Sustained, long-term support.

6) Strong scientific and professional interest.

7) Cooperative research.

8) Optimisation of compromise.

9) Appropriate grant levels.

10) Effective coordinating staff.

11) Donor cooperation and coordination.

All of these factors probably will be addressed during this meeting, but I would like to stress the need for donor cooperation and coordination. This need should be emphasised for two reasons. Firstly, each donor agency has strengths and weaknesses which determine the limits of its effectiveness. For example, in the area of psyllid research support, the IDRC has granted to the MPTS Network substantial funds for psyllid research, yet has been generally unable to encourage and support regional coordination of psyllid researchers. The F/FRED project, on the other hand, has little money for research grants, but has effectively used travel and workshop funds to support the development of a coordinated regional plan for psyllid research. Both agencies have recognised these niches and worked together to maximise their efforts. Thus, donors need to understand the strengths and weaknesses of their research support programs, and work together to bridge as many research gaps as possible.

TABLE 1. RESOURCES REQUIRED FOR SUCCESSFUL NETWORK ESTABLISHMENT

Stage of network development	Critical elements	Personnel requirements	Other resource requirements
Organisation	The focus of the network is a topic or problem that is clearly defined and is common to many countries	Subject matter specialists actively consult with network participants in designing network structure and activities	Adequate funds for initial infrastructure development and travel for organisational purposes
	Sufficient interest exists in network topic to warrant further development	This initial commitment is most likely to come from an institution with strong commitment, but without assurances of future funding	This may be limited to office space and facilities for the organiser until funding sources can be identified for the establishment stage
Establishment	Adequate funding is allocated for a minimum start-up period of 5 years	Subject matter and training specialists, publications, and administrative staff are required	Funds for network meetings, publications and research are required
	Participants are willing to share both research results and training materials	Coordinating staff provide leadership in organising and implementing in the early years of this stage; this evolves to a "facilitation role" which supports leadership of network participants	Donor support is critical to long-term success since the greatest financial inputs are required during this phase
	Participants are willing to commit resources for future network operations		

cont'd

Stage of network development	Critical elements	Personnel requirements	Other resource requirements
Operational	Network is sufficiently well developed to operate with reduced funding requirements An effective secretariat is established in a "neutral" institution Staff from participating institutions have sufficient training and expertise to contribute significantly Networks are guided by strong and effective leaders who have the confidence of the participants and who have recognised skills in the areas of network focus	Subject matter specialists, publications, and administrative staff are required Personnel requirements during this stage should be less than those during the establishment stage due to increased activities between institutions with little need for core support	Funds for network meetings, publications, and research are needed; a greater share of the required funding support for network operations should come from participating institutions, as well as a broad base of donor institutions A major source of funds should be the regular operating budgets of participating institutions in the form of personnel support for in-country activities, publications, and communications costs

Source: Adapted from MacDicken and Lantican (1988) by MacDicken (1989).

Secondly, I have to stress that Winrock is not a donor agency. Rather, our institute should be viewed as an active participant, who is keenly interested in learning, sharing information, and working with other researchers and institutions. Winrock can play the roles of facilitator, liaison, and technical assistant by sharing our experiences from other projects in Asia and other regions in the world.

Our institute has been involved in small ruminant research and training for a long time, and it remains committed to the advancement of small ruminant development. As research capacity in Asia has grown stronger, we firmly believe that research networking is a tool for addressing major research problems that makes maximum use of in-country research capacity. While developing networks, Winrock has learned several lessons about establishing networks and managing network activities. We have learned more through problem-solving and trial and error than through adherence to a well-defined methodology. Often, the management of these networks shifts over time from management of project activities by a centralised unit to management of activities by network participants. This shift reflects the need to adjust management strategies as the project and the network develop and to have participants take on greater responsibility for network activities.

Whatever strategy for an Asian small ruminant research network is decided on during this meeting, continued evaluation and reevaluation of the network's management structure is desirable.

ACKNOWLEDGMENTS

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SESSION III

CANADIAN UNIVERSITY PARTICIPATION

CANADIAN PARTICIPATION IN RESEARCH AND DEVELOPMENT OF SMALL RUMINANTS

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SMALL RUMINANT PRODUCTION IN ASIAN COUNTRIES

The role of small ruminants in providing adequate levels of protein in the diets of people in developing countries and in supplementing the income of farmers in climatically less favourable regions of the world is receiving increasing attention. Many developing countries may not have either the capital or the infrastructure to launch large scale dairy schemes with cows or water buffaloes. Even in countries where such schemes were developed with tremendous financial assistance from international agencies eg. Operation Flood in India, the provision of good quality forages consistently throughout the year appears to be one of the major constraints in ensuring adequate returns to the producer and maintaining the reproductive status of the herd in good condition. The pressure on available land for cereal production for direct human consumption is so great that the technology for the production and conservation of forages has not kept pace with the genetic gains achieved through cross breeding with exotic breeds. The result is that crossbred cows with high genetic potential depend largely on by-products and crop residues to meet their nutritional requirements culminating in reproductive problems and economic loss.

It is in this context that the distinct advantages of small ruminants come into focus in relation to their contribution in augmenting the income of the farmers in Asia. Among small ruminants, sheep production methods, in general, have improved substantially over the years. This may be ascribed to the large amount of basic research which has been done on various aspects of nutrition, genetics, reproduction and environmental physiology of sheep. It was therefore, relatively easy to modify modern production technology to suit agronomic conditions in the tropical areas. On the other hand, much less is known on the biology of goats and modern husbandry methods developed mainly for diary breeds in the developed countries are not applicable to conditions prevailing in developing countries.

Biologically, goats are able to utilise fibrous feeds more efficiently than cows or water buffaloes which would make them more suitable for thriving on crop residues normally available in developing countries. Being browers, goats can live on tree leaves and shrubs so that they do not compete with man for arable lands under arid or semi-arid conditions. Their ability to bear twins and triplets as well as their shorter gestation give them a higher reproductive efficiency than large ruminants.

Secondly, in many peasant societies, goats have long been accepted traditionally as integral components of the agro-ecosystem. Even today, goats are penned at nights in arable lands to use their manure as a source of organic fertiliser. Though goat production in many developing countries is still in the hands of poorer sections of the community, conventional husbandry practices have been developed and established over the years. In other words, the infrastructure for goat husbandry exists in most developing countries and there is scope for enhancing production by modifying older practices and introducing modern technology.

Thirdly, goat meat constitutes the major source of meat consumed in many developing countries. The meat is lean and does not have the religious taboos associated with beef. The marketing of goat meat thus poses no problems.

Finally, one of the general criticisms of developmental schemes operating in developing countries is that they are designed towards the more affluent population and do not reach the small and marginal farmers with minimal capacity to invest or experiment or take risks. Under these conditions, goat production, by virtue of having its origin in the rural areas is most likely to augment the income of the low and middle income groups. Despite these advantages, goat improvement programs were hampered by the misconception that goats were responsible for deforestation and soil erosion due to their indiscrimate browsing behaviour. As stated by Devendra and Burns (1983), "prejudice against rearing goats may be widespread among the advisers than the advised". Several excellent reviews and monographs have been published on goat production in tropical countries (Devendra, 1980; Makckenzie, 1980; Gall, 1981; Devendra and McLeroy, 1982; Devendra and Burns, 1983; Winrock International, 1983; Timon and Hanrahan, 1985).

WHY CANADIAN PARTICIPATION?

Recognising the significance of small ruminants for the economic uplift of farmers in rural areas, governments in many developing countries have launched programmes to introduce modern technology to improve sheep and goat production. Over the years, Canadian academic institutions, government departments and private companies have been useful partners in these endeavours and have contributed significantly to international development in the fields of agriculture, food and nutrition, social and engineering sciences and communications.

The Canadian International Development Agency (CIDA) has offered technical assistance to developing countries in the areas of dairy, beef and small ruminant production through Canadian universities and private agencies. The International Development Research Centre (IDRC) was created in 1970 as a public corporation with the philosophy that scientific self sufficiency in any country can be achieved by scientists making their own decisions, managing their own resources and learning by their own mistakes. IDRC helps to create and support international networks through which developing countries can learn from each other, share common experiences and conduct similarly designed studies in areas of mutual concern. The Centre also promotes cooperation between researchers in developing countries and their counterparts in Canada. IDRC has its headquarters in Ottawa with six

regional offices in Bogota (Colombia), Cairo (Egypt), New Delhi (India), Nairobi (Kenya), Dakar (Senegal) and Singapore. Examples of animal oriented projects supported by IDRC during 1987 to 1988 are given in Table 1.

TABLE 1. ANIMAL ORIENTED PROJECTS IN DEVELOPING COUNTRIES FUNDED BY IDRC DURING 1987-1988

Name of Project	Country	Amount (CAD)
Farming Systems	Costa Rica	369,500
Pasture Improvement	Zimbabwe	188,600
Dairy Feeding Systems	Tanzania	209,800
Goat Production Systems	Nepal	80,500
Sesbania Germplasm	Ethiopia	11,000
Asian Fisheries Society	Philippines	420,000
Goats and Sheep	Zimbabwe	300,100
Buffalo for Draught Power	Thailand	156,600
Dairy Production Systems	Ethiopia	370,900
Dairy-Beef Production	Botswania	395,300
Buffalo for Draught Power	India	48,600
Tropical Pastures	Colombia	671,000
Integrated Livestock and Aquaculture	Cameroon	249,800
Crop-Animal Systems	Philippines	327,500
Dairy-Beef Production	Gautemala	404,000
Small Ruminant-Coconut Systems	Philippines	160,000
Rice-Fish Improvement	Indonesia	410,000

The kind of projects funded and the extent of supported provided would give an indication of the Canadian commitment towards international development. It is in pursuance of this policy that the present meeting has been arranged to explore the possibility of establishing a network for the development of small ruminants for Asia. It is therefore pertinent to examine the scope of the network and how the Canadian universities can be of assistance in training personnel, offering technical expertise and creating a forum for the exchange of view by scientists working in this area.

CONCEPT AND SCOPE OF THE NETWORK

The objectives of establishing a network have been outlined succinctly in a publication entitled "With our own Hands" by IDRC (1986) and some relevant sections are reproduced below :

"A researcher working up in the Andes or down in the Kalahari would never transform research effort into global or even communal benefit if operation as a scientific recluse. Such a researcher needs to establish linkages with colleagues in the South and, possibly in the North; and perhaps with the international development community and research funding agencies at home.....Helping to make linkages is indispensable both to a sound research capacity and to the achievement of useful and used results. One of the means used by IDRC has been through 'networks'.....A network may be said to exist when two or more related projects are deliberately linked by the sharing of

information, activities, or resources and through a coordinating mechanism".

The need for the establishment of a network will be evident if one considers the large amount of research that is being conducted in many Asian countries by many individuals in the area of small ruminant production. In addition to the redundancy of research efforts, the opportunities to learn from each other's experience is lost. For example, an area of primary concern common to all Asian countries is the improvement of the nutritional quality of lignocellulosic fibrous materials and the use of by-products in ruminant rations. Though the appropriate technology which is effective, economically feasible and capable of being accepted under village conditions poses a challenge to scientists and extension workers in developing countries, very little effort has been made to share the experience of the countries in the region. Similarly the integration of crop-animal farming systems is another area which would lend itself for consideration under the umbrella of a network.

In addition to facilitating the exchange of research findings among countries in the region, the network would provide a forum to identify common problems and explore ways of tackling them. Given the differences in geography and administrative set-up in different countries, this function of the network can be underestimated.

Creation of two separate networks, one for sheep and another for goats, would have the advantage of recognising the management problems unique to each species and catering to their specific requirements. This has to be weighed against the cost of running two networks.

SPECIFIC AREAS OF CANADIAN PARTICIPATION

With the above background on the need for the creation of a network to promote small ruminants production in Asia, it is pertinent to discuss the specific areas in which Canadian Universities may participate and contribute to the overall functioning of the network.

It is envisaged that Canadian Universities would be involved in three basic functions :

1) Training of research personnel from participating countries.

2) Participation in discussions leading to the choice of suitable research projects in a coordinated manner.

3) Collaborative research with individual scientists and/or research institutions.

Training of Personnel

The training of research personnel from developing countries on various aspects of small ruminant production may be done in a formal or informal manner.

Formal training to students wishing to pursue Master's and PhD degrees is currently being given in agricultural and veterinary faculties in Canadian Universities. Many students are sponsored by

their governments under the auspices of various scholarship and fellowship plans. Others are supported by research grants of individual faculty members in Canadian Universities. This practice will be continued with the added stipulation that the topics chosen for the thesis will be relevant to the improvement of small ruminant production. Alternatively, students may be allowed to take appropriate courses at Canadian Universities and return to their countries to conduct research work for their thesis in their own native environment.

Informal training would entail short or long term visits to Canadian institutions of selected individual from developing countries for periods of 3 to 9 months to enable them to learn specific techniques without registering for a formal degree. Appropriate funding should be made available to the participating Canadian University for supporting the trainees and for carrying out research. It would also be necessary to allocate money for travel of the faculty members to visit the country where the trainees hail from to enable them to obtain a first hand knowledge of the conditions and problems.

Canadian Participation in Identifying Areas of Work

In view of the differences in geography, agronomic conditions, political and social factors, and available infrastructure for research and extension, the nature of constraints confronting small ruminant production in developing countries is likely to be different. The expertise of the Canadian faculty members will be of immense value to the participating countries in identifying common technological problems and explore ways and means of solving them. Some problems may be relevant to one country or region and need to be tackled only at the local level while others may be of a more general nature calling for an integrated approach.

To illustrate the role of Canadian scientists in the proposed network for the promotion of small ruminant production in Asian countries, examples are given in Table 2 of some of the constraints likely to be encountered and the improvements needed in management practices along with the relevant research tools required for this purpose.

Topics such as integrated farming systems involving crop-tree-small ruminants, availability of conventional and non-conventional feed resources and the desirable breeds for a region can be addressed only by scientists who are familiar with local agronomic and rural conditions. On the other hand, investigations on forage evaluation, rumen fermentation, whole animal nutrient utilisation, manipulation of estrous cycles, physiological responses to environmental conditions and quantitative analysis of genetic progress achieved in a population employ research methodology of a more fundamental nature. Canadian scientist will be very happy to share their expertise and experience in these and other areas with colleagues in Asia countries to improve small ruminant production. The thrust of Canadian participation would thus lie in providing expertise to tackle common problems on a global basis especially in countries which may not have the trained manpower or the facilities to undertake appropriate research.

TABLE 2. MANAGEMENT GOALS AND RELEVANT RESEARCH TOOLS FOR IMPROVING RUMINANT PRODUCTION IN ASIA

Management	Goals	Research tools
Feed resources	Inventory and utilisation of conventional and non-conventional feeds	Forage analysis and evaluation
	Enhancing nutritional quality of lignocellulosic materials	Comparative rumen microbiology and fermentation characteristics
		Site and extent of nutrient digestion
		Rate of passage of digesta
		Energy, nitrogen and mineral metabolism
	Forage production and conservation	Innovative extension methods
Integrated farming	Crop-tree-small ruminant integration	Agronomic principles
	Cropping patterns	Economic analysis of farm returns and extension
Housing	Sheds, fencing and ventilation	Physiological and growth responses to temperature and humidity
Breeding	Desirable breeds : cross-breeding	Application of principles of population genetics
	Progagation and distribution of breeding stock	Innovative extension/ organisation
Disease control	Reduction in worm burden	Cost and efficacy of anthelmintics
	Viral disease prevention	Immunological techniques
Production	Growth characteristics	Whole body protein synthesis
	Meat, milk quality	Chemical composition/ processing

Collaborative Research

Collaborative research with individual scientists and/or institutions in Asian countries by Canadian scientists to improve small ruminant production may be arranged on an individual basis or according to the needs of the participating countries.

In order to facilitate the exchange of views among research workers, an annual meeting of the participants be held at various centres on a rotating basis. The major objective of this meeting will be to identify specific problems pertaining to small ruminant production which will be of concern to all countries, so that they can be tackled on a global basis. The advantage of collective wisdom in these situations is obvious. The Canadian representative can also help locate suitable experts in different disciplines (agronomists, soil scientists, agricultural economists) to solve specific problems.

Secondly, the network HQ will disseminate the information so gathered to participating countries in the form of proceedings, research bulletins etc, so that researchers are well informed as to who they should contact for specific answers to their problems. Though IDRC is currently publishing proceedings of such meetings (for example, Devendra, 1987), the proposed structure will ensure continuity and adequate distribution of available information. Indeed, by maintaining a computerised data base, the network HQ can serve as a useful resource facility for small ruminant research.

Thirdly, periodical meetings of this nature would give an opportunity for the participants to listen to the experience of others in solving specific problems. Some countries may be more advanced than others in launching successfully a new technology or adopting a novel extension approach and it would only be necessary to send trainees to that country instead of Canada. For example, the successful implementation of the integrated farming system involving crops, trees and small ruminants in several southeast Asian countries may be a model for others to follow.

It may be advantageous to set up areas of excellence in different institutions in the region so that they may serve as a nucleus for the propagation of concepts or methods. It may be also necessary to let the organisation of the network evolve over gradually over a few years after the initial establishment of the network. This would give enough time to rectify initial decisions which may turn out to be wrong subsequently. At any rate, it is hoped that the partnership in research initiated under the auspices of the network will go a long way not only in improving small ruminant production but also lead to a better understanding among the people in the participating countries.

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CONCLUSIONS AND RECOMMENDATIONS

The conclusions and recommendations of the meeting resulted from two defined objectives. These were firstly, examining the desirability of forming a network appropriate to support research and development of small ruminants, and secondly, issues of the organisation, coordination, and their implementation in Asia. The meeting was attended by representatives from 11 countries in Asia (Bangladesh, China, India, Indonesia, Malaysia, Nepal, Pakistan, Philippine, Sri Lanka, Thailand and Vietnam) plus observers from Canada and New Zealand, and five international donor agencies : Australian Centre for International Agricultural Research (A.C.I.A.R.), Japan International Cooperation Agency (J.I.C.A.), Deutsche Gesellschaft fur Technische Zusammenarbeit (G.T.Z.), International Development Research Centre (I.D.R.C.) and Small Ruminant Collaborative Research Support Project (SR-CRSP) of the United States Agency for International Development (U.S.A.I.D.).

This meeting represented the culmination of three previous meetings on small ruminants in Asia, and was in direct response to some of the pressing issues that were recommended in those Workshops. The proceedings of those workshops have been published and are:

1) Small Ruminant Production Systems in South and Southeast Asia (1986).

2) Goat Meat Production in Asia (1988).

3) Sheep Production in Asia (1989).

COUNTRY STATEMENTS

Session I opened with a paper on networks and their mode of operation. This was followed by a presentation and discussion of the 11 country papers with specific reference to research and development priorities on small ruminants. The papers referred in particular to the trends in the population of goats and sheep, breeds, products, main research activities, highlights, and finally a statement on future priorities and directions.

The papers demonstrated that there was a very wide range of environments involved, from the high mountains and plateaux of the Himalayas, to the intensively cultivated smallholdings of the humid tropics. The types of research and the priorities within disciplines and within species for each country reflected these differences as well as the general status of sheep and goat development in each country. All countries listed breeding, reproduction, nutrition, management and diseases, marketing as important research topics and recommended that these be included in research and development programs.

Despite the various country differences, the perceived research and development priorities of the eleven countries in the region indicated that in nine of these, goats were considered relatively more important in the foreseeable future. There was agreement that breeding was an important issue, but highly dependent on the characteristics of specific production systems within individual countries. There was a need for baseline

production data on indigenous breeds, conservation of endangered pure breeds and documentation of high fertility breeds. Crossbreeding leading to new breed formation had greatest support. Nutrition and management received second priority but, depending on the country emphasis, varied between fodder and pasture production, supplementation, use of agro-industrial by-products, ammoniation of straws, feed requirements and feeding strategies. In general, all countries required a research effort which embraced all disciplines, including socio-economics and marketing across all production systems and the transfer of technology to on-farm situations. The identification of the real constraints at the farm level should be the first step to guide the research efforts. To achieve it, interdisciplinary research approaches need to be used.

DONOR STATEMENTS

In Session II, presentations were also made individually by ACIAR, JICA, GTZ, IDRC, USAID/SR-CRSP, and Winrock International. The possible contribution that Canadian Universities could make to support the network formed the seventh paper in this session.

The opportunity was taken to have an informal meeting of the five donor agencies attending the meeting to seek their views as well as potential support for the network. This meeting was generally positive and closer participation and linkages among them in the future will be dependent on the development of clear proposals and direction of the network. Possible areas of collaboration include the establishment of the coordination unit, training and information exchange, and individual responsibility to host future network meetings.

THE NETWORK

Sessions III and IV focused on the needs and formation of the network as well as the information centre. This was followed by long discussion and deliberations on issues related to the network and how it might operate. It was recommended that the establishment of this network was desirable, and should be implemented.

The following summary of the recommendations represent the overall consensus of the meeting, the main conclusions and recommendations :

- There was a consensus that a single network should be established for small ruminants in Asia.
- The name of the network should be Small Ruminant Production Systems Network for Asia (SRUPNA).
- There was a general feeling that the establishment of SRUPNA should begin modestly in keeping with the limited resources available, the complexity of the task, the need for sustainability and the variable needs and aspirations of individual countries.
- The general objective is to strengthen research and development activities for small ruminants in national agricultural systems and collaborative research programs.

- The specific objectives of SRUPNA are to :
  - Increase the exchange of information.
  - Strengthen research on production systems (extensive, systems combining arable cropping and systems integrated with tree cropping) including socio-economic and marketing factors.
  - Promote training activities (formal and informal) and curricula development appropriate to small ruminants.
  - To promote the utilisation of research results.
  - Facilitate exchange of germplasm (animal and forage).
- Participation should be flexible and open to all countries.
- The activities of the network will be defined and controlled by a steering committee with clear terms of reference.
- There should be a coordination unit and a coordinator to implement the network objectives and activities.
- The following three persons were elected members of the steering committee :

  Dr R M Acharya (Chairman, India)
  Prof An Min (China)
  Dr A Djajanegara (Indonesia)
- All donor agencies interested in small ruminants are also members of this steering committee.
- The steering committee with support from IDRC was charged with the task of soliciting proposals from interested countries, and finally identifying an appropriate coordination unit to sustain the activities of the network.

THE INFORMATION CENTRE

The meeting agreed that there was a need to establish a centralised information facility called Asian Small Ruminant Information Centre (ASRIC). The site for this is to be the Central Sheep and Wool Research Institute (CSWRI) in Avikanagar in India. The Government of India has pledged support for undertaking this commitment.

It was recommended that ASRIC include among its functions :

- The publication of a small ruminant newsletter to provide a means of information exchange.
- The setting up of a working group on identification and standardisation of minimum data sets useful for research on small ruminants and technology transfer.

- Acting as a network resource centre with a clearly defined role to provide information products and services, particularly to scientists in the network.

- The establishment of a micro-computer data base for distribution to participants.

Delegates were unanimous that attention be given to the management of ASRIC to sustain the long term goals.

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